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Moscow NEFTYANOYE KHOZYAYSTVO in Russian No. 10, Oct 77 pp 2-146

CONTENTS PAGE

CONTENTS (Continued) Page

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HISTORICAL DEVELOPMENT OF PETROLEUM, GAS PRODUCTION

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 2-7

[Article by N. K. Baybakov, USSR Gosplan Chairman: "The Petroleum and Gas Industry in 60 Years of Soviet Rule"]

[Text] A date of enormous historic importance is approaching--the 60th jubilee of the Great October Socialist Revolution. The history of the development of human society has few landmarks to equal our Great October.

The emancipation of labor in the workers' and peasants' state and the Soviet people's successful implementation, under the guidance of the Communist Party, of Lenin's ideas, have made it possible to win the civil war, to cope with the devastation and famine of the first years after the revolution, to pass the most difficult test and rebuff the fascist onslaught of 1941--1945, to restore the war-devastated economy, to raise the social and cultural standard of living of the Soviet people immeasurably, and to grow into a powerful state of highly-developed socialism.

In our first jubilees we proudly and enthusiastically compared what we had achieved with 1913. Now, these comparisons are made in two- or even three-digit numbers, because the USSR has become one of the leading states in the world economy.

An enormous achievement and superiority of our country over the capitalist countries is the capability of planning and implementing grandiose plans of national economic development. The nine completed five-year plans constitute brilliant proof of this. Democratic centralism in planning, absolute plan balance, socialist competition, and material incentive--these constitute the vital principles of our socialist development and planning.

These advantages have been manifest, in particular, in the vigorous growth of the USSR's fuel and energy complex, which is the foundation of the development of whole economy. For without electricity, industrial and utility fuel, and hydrocarbon raw materials for chemistry and transport the modern life of society would be inconceivable. At the same time, the exploration of reserves of mineral fuel, their extraction and transport to places of consumption,

completely depend on many adjacent sectors--especially ferrous metallurgy and machine building.

The most important sectors included in the fuel-energy complex--electrical power engineering, petroleum, petroleum refining, gas, and coal industry--have in the past 60 years increased the production of fuel-energy resources by 38 times. The Soviet people's patriotism in combination with the country's industrial-economic potential made it possible to restore the pre-war fuel-energy resource production level in 1957 and to exceed it by 7.5 times by 1977. It is sufficient to note that the production of electricity in the past 60 years has increased by 527 times, coal production by 24 times. At the same time it is necessary to emphasize the special place which the petroleum and gas industry occupies in strengthening and developing our country's national economy.

From the very first days of Soviet rule, decisive steps were taken to develop a state petroleum industry. On 18 May 1918 V. I. Lenin signed the RSFSR Sovnarkom [Council of People's Commissars] decree on instituting the Main Petroleum Committee within VSNKh [Supreme Council of the National Economy].

Exerting heroic efforts under the guidance of the Bolshevik party, the country's petroleum workers raised petroleum production to the 1913 level by 1927--10 million tons; in another five years they doubled, and by the beginning of the Great Patriotic War they delivered 31 million tons.

Since the very beginning of the creation of the Soviet state, the efforts of scientists and practical geologists have been directed toward expanding the petroleum industry's raw materials base.

The first industrial petroleum deposit in the Volga-Ural petroleum and gas province (the Chusovskiy Gorodkov area) in 1929. This and subsequent discoveries confirmed Academician I. M. Gubkin's predictions concerning the petroleum and gas bearing potential of the territory between the Volga and the Urals. New deposits were discovered in the 1930's in the Baku and Groznyy areas, on the Emba, in Turkmenistan and on Sakhalin, and, in the North Caucasus, fields connected to the "bay-shaped" deposits in the Maykop formation on the Kuban'. But by the beginning of the Great Patriotic War, more than 71 percent of the petroleum was produced in Azerbaydzhan.

During the Great Patriotic War, the petroleum industry underwent severe trials. The enemy tried to capture the petroleum regions, especially the Caucasus--the country's main petroleum base.

During those years as well, however, 38 new petroleum and gas fields and deposits were discovered primarily in the eastern part of the country, including Yablonovyy Ovrag, Tuymazy, Zol'nyy Ovrag, Yelshanka, Yuzhnyy Koshkar, Palvantash, and others. Of special importance was the discovery of industrial petroleum in the Devonian deposits of Yablonovyy Ovrag and Tuymazy. These discoveries radically changed the economic-geographical structure of

the petroleum industry and later on brought about a powerful rise in our country's petroleum production.

The war years gravely affected the condition of the petroleum industry. Production in 1945 came to 19.4 million tons, drilling volumes dropped to 975,000 meters, including 395,000 meters in exploratory drilling.

The First Session of the USSR Supreme Soviet (Second Convocation, 1946) passed the "Law on the Five-Year Plan of Development of the National Economy USSR for 1946-1950." The country undertook to fulfill the Fourth Five-Year Plan--the five-year plan of restoration and development of the national economy.

The country's petroleum workers face the task of restoring war-destroyed production fields, boosting the volume of exploratory-prospecting operations, regaining the pre-war level in the shortest possible time, and achieving a production of 35.4 million tons by 1950. This task was honorably completed.

Increasing petroleum production in the area between the Ural and the Volga brought it closer to the main regions of petroleum product consumption and improved petroleum supplies to the country's European territories.

Overall, regional industrial petroleum bearing potential was determined in the Devonian deposits of the whole Volga-Ural territory, from the Timano-Pechorskaya province in the north, in Permskaya, Kuybyshevskaya, and Orenburgskaya Oblasts, in the Bashkir and Tatar autonomous republics, and the Saratov-Volgograd region along the Volga in the south. Putting the petroleum fields of these regions into operations largely determined the vigorous growth of petroleum production from 38 million tons in 1950 to 140 million tons in 1960, and the share of the Ural-Volga regions in overall production rose from 29.1 to 70.5 during that period.

High-yield petroleum and gas deposits were also found in the Mesozoic deposits of the Stavropol' area, Groznyy, Dagestan, and Krasnodarskiy Kray.

The discovery of several fields in the Caspian Sea, including the offshore Neftyanyye Kamni, which is unique in infrastructure and operation, made it possible to increase production sharply in Azerbaydzhan--our country's oldest petroleum production region.

The Kotur-Tepe and Kumdag fields were discovered in Western Turkmenistan, also high-yield deposits in fields already in production.

During those years, the Yuzhnyy Alamshik, Izbasken, and other fields went into production in Central Asia, in the Fergana Valley; the Karaton field went into production on the Emba.

The years 1961-1975 marked a qualitatively new stage in the development of the petroleum and gas industry; during that period our country emerged in first place in world petroleum production. This period is characterized

by the development of completely new petroleum and gas producing regions, especially in Western Siberia. Despite great natural difficulties, in 10 years (1965—1975), petroleum production in that region rose from one million to 148 million tons.

A new petroleum production region was developed on Mangyshlak Island on the basis of the Uzen' and Zhetybay fields. Production was organized in Belorussia, and with the introduction of the new Usa and Vozey fields production rose in the old Timano-Pechorskiy region.

No other country in the world has had such steady high growth rates of production in the last 15 year period. From 1961 to 1975, the average annual production increase rate in the USSR was 8.3 percent, and the absolute increase was 343 million tons. The Soviet Union's share in world petroleum production during those years rose from 14.3 to 18 percent, whereas the United States' share dropped from 32.2 to 15.1 percent.

The development of our country's petroleum industry during the years of Soviet rule has been based on the introduction of new equipment and technology for petroleum field development and well operation.

The years 1927-1928 saw the publication of the works of V. V. Bilibin, who examined the effect of well placement density on well yield. The works and speeches of Academician I. M. Gubkin with regard to petroleum field development, taking account of physical-geological and economic factors, became widely known and used in practice.

Of invaluable importance were the works of Academician L. S. Leybenzon and his followers, who founded modern underground hydrodynamics, a science being used to resolve key problems of rational petroleum field development.

Soviet scientists went on to develop scientific principles with regard to new methods of petroleum field development, the use of which in practice has substantially increased the economic effectiveness of petroleum production.

The application of artificial activation on strata by injecting water into them began with the Tuymazy field and then became widely used and perfected (contour, cyclical, selective, pattern, and other types of flooding). At present, the proportion of petroleum production using artificial methods for maintaining stratal pressure amounts to more than 85 percent of the total production in the country.

Artificial activation of petroleum strata (the maintenance of formation pressure, the injection of surface-active agents, and so on) makes it possible to raise the degree of petroleum extraction from balance reserves in the ground to an average of about 40 to 50 percent throughout the country as a whole and to reduce the number of operational well substantially. All of this has improved the sector's effectiveness and yielded savings of tens of

billions of rubles in capital investments and production costs, hundreds of thousands of tons of metal, cement, and other materials.

At the present stage of petroleum industry development, a central task is that of raising the degree of extraction from strata to 55--65 percent of balance reserves. Resolving this task involves the introduction of secondary and tertiary methods of field development. Active efforts along these lines that have been started in the fields of Bashkiria, Tataria, Azerbaydzhan, Sakhalin Island, and other regions should become extensively developed.

Much has also been done in the field of petroleum well operation equipment and technology. Enormous progress has been made in 60 years from primitive bailers to automated and remote-controlled production operations. In the 20 pre-war years a planning and machine building base was set up to supply the petroleum industry with deep well pumps, rods for them, pumping units, gusher fittings, and other equipment and tools.

The Great Patriotic War temporarily halted the development of petroleum production equipment. But right after the war ended, work was continued on the technical retooling and modernization of petroleum field equipment. The petroleum industry came to be outfitted with perfected pumping units, including the new dimensional series, the design and quality of deep well pumps and rods were improved, rodless pumps of high productivity came into widespread use, gusher fittings were perfected, and so on. Simultaneous-separate extraction from several strata and separate injection of water into the strata through one well came into use. During the Ninth Five-Year Plan alone, 132 fields were fully automated; by the end of the Tenth Five-Year Plan, these fields should account for 85 percent of the country's production.

A crucial role in the preparation of raw materials resources and increased petroleum and gas production is assigned to the drilling of exploratory and operational wells. Well drilling volumes rose from 280,000 meters in 1913 and 6,000 meters in 1921 to 15.5 million meters in 1976.

Qualitative changes have taken place in drilling operations, their equipment ratio and success rate. In the past, well depths did not exceed 500 to 700 meters; now, hundreds of wells go down 4,000 to 5,000 meters, and some of them go down more than 6,000 meters. Massive drilling is underway in swampy areas (cluster drilling).

The percussion drilling that we inherited came to be replaced by rotary drilling and then--a remarkable achievement of Soviet engineers--by turbine and turbo drilling.

Unit-by-unit installation and dismantling of drilling equipment has been largely replaced by large-block operations; this has reduced the amount of time spent in these operations by five to six times.

Pre-revolutionary schedule speeds did not exceed 100 meters per rig-month, yet in 1976--despite the fact that average depths were three times greater--schedule speeds in operations petroleum drilling were 1,550 meters per rig-month, including 3,600 meters per rig-month in Glavtyumenneftegaz [Main Tyumen' Petroleum and Gas Administration].

The success of drilling operations is based on the growing industrial power of the USSR. Metallurgy and machine building plants are supplying the country's drillers with resources which make it possible to improve the success rate enormously.

The Land of the Soviets inherited from the czarist regime a petroleum industry that had been destroyed by war and plundered by the concessionaires. After restoring it, the Soviet people undertook to develop a petroleum refining industry equipped with modern processes. During the pre-war five-year plans, new refineries were built in Batumi, Ufa, Ishimbayevo, Odessa, Moscow, and other places. The principle was adhered to of locating the refineries close to the regions of consumption; this principle yielded considerable economic benefit. During that period, Soviet facilities and equipment were developed which were quite modern for the time, double-furnace thermal cracking Soviet pipe stills. During the pre-war period, the Soviet people not only restored but also technically retooled the petroleum refining industry.

During the Great Patriotic War, the petroleum refiners did not stint on efforts to supply the front and the rear with fuel and lubricating materials, and made a worthy contribution to the cause of victory.

Especially substantial success in the development of the petroleum refining industry was achieved during the post-war period. The rising demands of the national economy and the country's defense needs with respect to expanding the assortment of petroleum products and improving their quality and increasing their quantity promoted the development of this sector of industry. Joint efforts by scientists and production workers helped to supply the petroleum refining industry with modern, high-productivity equipment; these efforts helped to create perfected technologies for the production of the needed assortment of petroleum products.

One of the most important tasks of the post-war period was mastering a process of refining sulfur and high-sulfur petroleum as a result of increased volumes of production of such petroleum. During that period, the country built a large number of major petroleum refineries, locating them in almost all the economic regions, for example Omskiy, Angarskiy, Novokuybyshevskiy, Novo-Gor'kovskiy, Kirishkiy, and others; in Belorussia, two major refineries were built--the Polotsk and the Mozyr'; in the Ukraine, a refinery was built in Kremenchug, and the one in Kherson was enlarged. New refineries are being built in Eastern Siberia, Kazakhstan, Turkmenia, and the Baltic area.

Major qualitative changes took place in the outfitting of refineries with apparatus and equipment. Capacities of technological installation involving individual processes were increased substantially. For example, installation capacities for primary refining processes increased by more than 10 times (from 0.5--0.6 to 6--7 million tons per year); in the case of catalytic reforming--by four times, and so on.

In terms of the volume of industrial output, the petroleum refining industry holds one of the leading places in our country's national economy.

The period after the May 1958 Plenum of the CC CPSU is characterized by the development of a new industrial sector--petrochemistry. Vigorous development is currently underway in the petrochemical industry, involving the tooling of separate enterprises and individual shops and technological installations in refineries.

Work is successfully underway on reducing the harmful impact which petroleum products and refinement wastes have on the environment. Water consumption as well as the discharge of waste water is being reduced substantially through recycling and the use of air cooling apparatus. Waste water is being subjected to multi-stage treatment to yield good purification. Improved hermetization and equipment and the use of distillate hydro-refining have made it possible to reduce harmful gas emission substantially.

Workers in the refining industry are expending considerable effort to develop this sector and improve its work. The more than one-half million refinery workers are justly proud of what they have achieved.

The history of the development of the Soviet gas industry can be divided into two basic stages.

In the first stage, which ended by the 1950's, the gas industry developed side by side with the development of petroleum production, chiefly in terms of utilizang petroleum gases and small volumes of natural gas.

In the early 1950's, the rapid expansion of the raw material base for the production of natural gas, and the large economic effect gained from its use in the national economy, revealed the economic necessity of developing a gas industry as a new sector of the economy. In 1956, the gas industry was set apart as an independent sector of the economy, with a unified centralized administration. This marked the beginning of the second stage of its development, characterized by a systematic rise in the volumes and rates of development due to expanded filling out of reserves of natural gas and continuous improvements in production techniques. In this way, the gas industry, which started as part of the petroleum industry, in a short time became a powerful sector of the economy; this has been especially facilitated by a 10-fold increase in industrial reserves of gas over the past 15 years.

It should be pointed out that before the revolution, there was no gas industry to speak of in Russia. But from the very first years of the existence of the Soviet state, gas production began to rise gradually, and by 1940 it came to 3.2 billion cubic meters. Moreover, about 80 percent of gas production was concentrated in the petroleum fields of Azerbaydzhan.

The years of the Great Patriotic War saw the beginning of the development of long-distance gas transport. In 1941-1942, a pipeline was built from the gas fields near Buguruslan and Pokhvistnevo to Kuybyshev, a distance of 160 km, 300 mm in diameter. In September 1943 it carried the first gas to major enterprises in Kuybyshev.

The Yelshanskoye field and other fields in the Saratov region became the main base of the country's first long-distance pipeline between Saratov and Moscow, a distance of 800 km, 325 mm in diameter.

The discovery of new gas and petroleum-gas fields in the Komi ASSR, the Volga area, the Ukraine, the North Caucasus, Central Asia, and Siberia made it possible to boost gas production to nine billion cubic meters by 1955. By late 1955, long-distance gas pipelines totaled 4,860 km. Until the recent past, however, the share of gas in the country's fuel balance remained insignificant: 2.4 percent in 1955, 7.9 percent in 1960.

Subsequent discoveries of major gas fields in Northern Tyumenskaya Oblast, Turkmenia, the Ukraine, the Komi ASSR, Orenburgskaya Oblast, and Uzbekistan made it possible to boost gas production throughout the country by 35 times compared with 1955.

Gas production over the past three five-year plans has risen by 6.4 times, with average annual increases of more than 16 billion cubic meters. Especially large increases were achieved in 1974--1976 (24 and 32 billion cubic meters, respectively). There was a sharp increase (from 2.4 percent in 1960 to 46.5 percent in 1975) in Western Siberia's and Central Asia's share in the overall volume of the country's gas production.

An indispensible part of the gas industry's development is the construction of pipelines from fields to consumers. Unlike the United States, we have embarked on a path of building large-diameter pipelines (up to 1,420 mm) with pass-through capacities of 28.0 billion cubic meters per year.

Until the Ninth Five-Year Plan, gas was produced chiefly in the European territories. Now and in the future, however, the greatest increases will come from the Eastern regions of the country. This will entail the construction of huge systems of long-distance pipelines from the eastern regions to the European territories, where the main consumers are concentrated.

From 1961 through 1975 alone, the USSR built 79,000 km of long-distance gas pipelines and branches, and the total distance increased by almost five times.

In this connection, exceptional importance attaches to increasing their productivity; this is achieved primarily by increasing operating pressure in them and cooling the gas being pumped through.

In recent years, the efforts of the All-Union Scientific-Research Institute of Electric Welding imeni Ye. O. Paton have resulted in the development of designs and technologies for producing multi-layer pipes which make it possible to boost pipeline productivity by two times at pressures up to 120 kgf/cm^2 and moderate cooling (-23°C). The practical implementation of this progressive proposal will begin at the end of the current five-year plan.

The power per productive unit on long-distance pipelines has increased substantially. The number of compressor stations and their capacity rose respectively from 21 compressor stations and 0.3 million kilowatts as of the end of 1960 to 320 compressor stations and 9.7 million kilowatts in 1975. The capacity of the compressor stations is rising chiefly as a result of increased unit capacity of the gas pumping units. Widespread use is being made of gas pumping units of 6,000 to 10,000 kilowatt unit capacity. Gas pumping units of 16,000 and 25,000 kilowatts capacity are being developed.

In connection with the high concentration of gas production coupled with the development of an integrated pipeline system on a large scale, great importance is coming to attach to problems of selecting the directions of gas flow and determining them on the basis of economics, reliable and performance under special conditions, and amounts of gas flow in one direction.

Thus, pipeline transport on the whole in recent years has come to be developed substantially on the basis of progressive technical and technological solutions which improve technical-economic indicators. However, the pace of development still lags behind the rising gas needs of the national economy.

Fuller utilization of the productivity of large gas transport systems, as well as regulation of irregularity in gas consumption by the main industrial centers of the country, is being provided by underground storage facilities built for the purpose.

Large reserves of casing head gas, from which liquified gas and casing head gasoline can be obtained, served as the basis for the development of natural gasoline production in our country. Between 1923, when the USSR's first natural gasoline plant was built in Baku, and 1956, five small oil-absorption natural gasoline plants and several carbon-adsorption units were built and put into operation. Since 1955, substantial efforts have been underway on the designing and construction of large natural gasoline plants for the refining of fat casing head gas in Bashkiria, Tataria, and Kuybyshevakaya Oblast. Between 1955 and 1977, several dozen natural gasoline plants have been built, and the volume of gas refining has risen substantially.

Such subsectors of the gas industry as the production of gas condensate and liquified gas have become further developed; the production of sulfur from

gas has gone into high gear. In this way, between 1961 and 1975 the gas industry became one of the key sectors of the country's economy.

Accelerated development of the gas industry is of great importance for the further strengthening of the economic power of the Soviet Union. With each passing year, natural gas is coming into more widespread use as an efficient and inexpensive type of fuel in such key sectors of industry as power engineering, machine building, ferrous and nonferrous metals, construction materials, and so on. Gas creates favorable conditions for improving technological processes, and it is becoming a vital factor in boosting labor productivity, providing considerable conservation of resources in the field of material production.

In addition, natural gas is a raw material for the chemical industry; it has great advantages for use as household fuel, and the use of gas in the national economy is helping to clean up the atmosphere in major cities and industrial centers of the country.

The development of the gas sector is inseparably linked to the enormous efforts of other sectors of industry--metallurgy, machine building, and construction materials--which have helped in the manufacture and delivery of millions of tons of steel pipe for gas industry facilities, along with powerful gas pumping units, thousands of specialized pieces of construction machinery and motor vehicles, and all kinds of construction materials and products.

The efforts of Soviet geologists and gas industry workers have created a reliable raw materials base for developing the gas industry at a rapid pace. In terms of explored reserves, our country holds first place in the world. At present, the USSR has 27 percent of world gas reserves.

During the jubilee year of the 60th anniversary of the October Revolution, the country's petroleum and gas workers will supply their homeland with 550 million tons of petroleum and gas condensate and about 350 billion cubic meters of gas.

Petroleum and gas industry workers have always been in the front ranks of the working class, and they enjoy the well-deserved respect of the Soviet people. The working people of the petroleum regions of Azerbaydzhan and the North Caucasus possess remarkable revolutionary traditions; they wrote more than one heroic page in the history of the struggle with the czarist monarchy and the establishment of Soviet rule in our country. Today the petroleum and gas industry employs a multi-national collective. Hundreds of thousands of workers, engineers, technicians, and employees--outstanding experts in their field--devote their efforts and skills to the development of our country's most important sectors of economy.

Achieving the goals of sector development mapped out by the 25th CPSU Congress will insure our country's place as the largest fuel producing country in the world. It is truly an enormous and honorable task for every worker in the sector.

Grandiose tasks will confront the petroleum and gas industry beyond the current five-year period. Workers of these sectors must insure further increased volumes of petroleum and gas production. Volumes of petroleum refining will rise accordingly. This will require new qualitative and quantitative approaches to the task. It will be necessary to complete the technical retooling of petroleum and gas geological-prospecting and geophysical operations, to improve the technical-economic indicators of drilling operations, and to perfect methods of developing petroleum and gas fields.

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PETROLEUM INDUSTRY ACCOMPLISHMENTS, PROBLEMS, PLANS

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 8-15

[Article by N. A. Mal'tsev, Minister of Petroleum Industry: "Petroleum Workers for the Jubilee of Great October"]

[Text] All of the Soviet people, implementing the historic decisions of the 25th CPSU Congress, are greeting the 60th anniversary of the Great October Socialist Revolution with new, high labor achievements. Social production is developing dyanmically; its effectiveness and work quality are rising on the basis of scientific-technical progress and increased labor productivity.

The 60th anniversary of Great October is an important landmark in the life of our people and all progressive mankind. During the years of Soviet rule, the country's economy has changed beyond all recognition. In 2.5 days now, industry produces as much as in all 1913.

For many types of production, including petroleum production, the Soviet Union is firmly in first place in the world.

Collectives of the enterprises and organizations of the sector, in response to the decree of the CC CPSU, the USSR Council of Ministers, the AUCCTU, and the CC Komsomol "To Increase the Effectiveness of Production and Work Quality and Successfully Complete the Targets of the Tenth Five-Year Plan" and the party's appeal for a fitting celebration of the 60th anniversary of October, and widely expanding socialist competition, have achieved new successes.

In the first eight months of this year, petroleum and gas condensate production throughout the ministry rose by 5.4 percent compared with the corresponding period of 1976. The gas production target was fulfilled by more than 400 million cubic meters. Drilling enterprises completed the construction of 300 wells above the plan.

Labor productivity in the industry rose by 4.2 percent, which accounted for 80 percent of the output increase.

The marketable production volume plan throughout the sector as a whole was fulfilled by 101.2 percent.

The present-day Soviet petroleum industry is a large-scale operation. At present, the economy receives every quarter as much petroleum and gas condensate as were produced in 1960. Gas production comes to more than 60 billion cubic meters per year. Large gas refineries are in operation in the sector.

In recent years, the overall length of long-distance petroleum pipelines has increased by more than 1.5 times, now amounting to about 50,000 km. Gigantic petroleum pipelines have gone into operation; they connect the new petroleum regions of Western Siberia, the Komi ASSR, the Western Kazakhstan to the European territories; the Druzhba petroleum pipeline system has been expanded.

Throughout the entire 60-year history of the Soviet state, the party and the government have focused great attention on the petroleum industry. Capital investments channeled into this sector have risen from five-year plan to five-year plan, from year to year. Production enterprises are being outfitted with new, perfected equipment.

The petroleum industry has always played a substantial role in resolving all economic-management problems. And Soviet petroleum workers have successfully carried out their assigned missions.

Immediately after the victory of the Great October Socialist Revolution, V. I. Lenin showed the greatest concern for the state of petroleum production in the country.

The Communist Party and V. I. Lenin personally assigned petroleum workers the task of restoring the petroleum industry and creating a basis for further development. This task was accomplished successfully.

A petroleum machine building industry was developed; this made it possible to accomplish the technical retooling of petroleum production.

Soviet scientists determined the principles of rational petroleum field development; these later merged into a harmonious system of theoretical postulates concerning the processes taking place in petroleum strata.

The findings of Soviet scientific research in this field have gained world recognition and set an example of reasoned approach to the use of petroleum resources. Thus, in the very first years of Soviet rule our country put an end to practices of injurious exploitation of petroleum resources.

In the 1930's, the petroleum industry's higher technical level made it possible to focus substantial attention on prospecting for new petroleum fields.

The main directions for prospecting-exploration work in the country were worked out under the guidance of I. M. Gubkin, D. V. Golubyatnikov, M. V. Abramovich, and others. As a result of expanded efforts along these lines, the adoption of geophysical methods of prospecting (which did not exist before the revolution), and the use of more sophisticated drilling equipment, in the 1930's a number of fields were discovered in Kuybyshevskaya Oblast and Bashkiria. Positive results were also achieved in Central Asia and the Emba region.

Further discoveries in the Ural-Volga region made it possible to formulate this task at the 18th party congress: "To Create a New Petroleum Base--A 'Second Baku'--In the Region Between the Volga and the Ural."

Petroleum workers managed to achieve this task after the Great Patriotic War. Despite the enormous difficulties caused by large scale destruction during the war, the party and the government found ways to allocate adequate material-technical resources and capital investments for the petroleum industry.

Petroleum regions of the Ural-Volga area came to be a nationwide construction project. Enormous help in developing the petroleum resources of this region was provided by experienced specialists from Azerbaydzhan and Groznyy.

Putting such fields as the Tuymazinskoye, Romashkinskoye, Arlanskoye, Mukhanovskoye, and others into operation in Bashkiria, Tataria, and Kuybyshev Oblast resulted in establishing the Ural-Volga area as the country's new main petroleum base. This area marks the beginning of the second stage of development in the Soviet petroleum industry.

This stage of development is linked to new scientific-technical progress in the sector.

In drilling, a prominent place is held by the bottom engine--the turbo drill--developed by Soviet specialists. In the sphere of technological field operation, flooding systems are being adopted and improved for maintaining formation pressure; these make it possible to increase the yield and regulate the pace of field exploitation.

The third stage of petroleum industry development, which began in the 1960's, is connected to the accelerated development of Western Siberia. During this period, fields have been put into production in such new regions as Mangyshlak Island, Belorussia, Udmurtia, Northern Komi ASSR, and other places.

It has taken enormous efforts to put the riches of the Siberian earth at the service of the economy. Impassable swamps, a freezing climate, and the lack of power facilities, communications, and transport--these are the conditions of development in this uninhabited land.

It was no accident that the Directives of the 24th CPSU Congress gave the development of Western Siberia the status of a State Program.

Thanks to the enormous and constant help provided by the CC CPSU and the Soviet government, substantial material resources were channeled into the area.

The development of the Siberian resources came to be a truly national cause.

Here I should like to emphasize specially the continuity of our traditions in the development of new petroleum regions. The best specialists came to Western Siberia from Tataria, Bashkiria, Kuybyshevskaya Oblast, and other areas. In a relatively short time, a remarkable collective of Siberian petroleum workers came into being, capable of resolving truly ambitious tasks.

In a short time and at a fast pace, petroleum production facilities were built, power facilities went into operation, power transmission lines were built, also transport communications, airports, cities, and workers' settlements.

As a result, in 10 years this region emerged in first place in the country's petroleum production.

The labor of the pioneers in this work was highly evaluated by CC CPSU General Secretary Comrade L. I. Brezhnev in his Accountability Report at the 25th CPSU Congress: "That which has been done and is being done in this severe land constitutes true heroism. And to those hundreds of thousands of people who are accomplishing it the homeland pays the tribute of admiration and profound respect."

One crucial step in the accelerated development of Western Siberia was technical progress in the petroleum industry, whose main direction was the retooling of petroleum production operations on the basis of automating the process flow charts of petroleum production fields and adopting new automated equipment for them manufactured in plants in the form of large transportable blocks.

The whole complex of these measures aimed at specific goals: reducing the specific number of personnel servicing wells; reducing the manpower need in field infrastructure construction; accelerating and reducing the cost of infrastructure through the adoption of industrial methods of construction. This kind of integrated technical solution was consistent with the interests of rapid and economical development of new fields, especially in remote, uninhabited locations with severe natural-climatic conditions.

The development of Western Siberia and other new petroleum regions, also enormous efforts on the part of petroleum workers to maintain production at a high level in the older traditional petroleum areas, account for the

achievement, in 1976, of the record annual production of 500 million tons of petroleum and gas condensate. These achievements embody the creative labor of scientists and production workers, builders, power engineering workers, machine builders, aviators, and all who are taking part in the development of the petroleum industry and the development of new petroleum regions. We see in them the selfless labor of the petroleum workers in the first years of Soviet rule, the first five-year plans, and the terrible days of the Great Patriotic War.

The labor annals of the Soviet petroleum industry include a whole constellation of production leaders. Among them are celebrated drilling experts such as Z. Parfenov, I. Polikarpov, Aga Neymatulla, A. Orlov, and Sh. Fatkuliyev from Baku, P. Tolush, A. Sal'nikov, and I. Shul'ga from Groznyy, N. Tsyupa and A. Khrishchanovich from Krasnodar, I. Polyakov, F. Knutov, K. Sabirzyanov, M. Gimazov, and I. Kupriyanov from the Ural-Volga area, and many many more.

The labor baton is now being worthily carried by the crews of foremen Heroes of Socialist Labor M. Gambarov and I. Guseynov from the Caspian, T. Vil'danov, I. Feklov, and G. Khadiyev from the Ural-Volga area, M. Sergeyev, A. Shakshin, G. Levin, and G. Petrov from Western Siberia, and hundreds of other crews. Selfless work is being done by the rig installers, repair workers, petroleum production workers and gas refiners, builders, and transport workers.

The creative labor of the many thousands of petroleum workers is always at the center of attention of the CPSU and the Soviet government.

At various stages of development of the petroleum industry, a key role in the achievement of new goals has been played by collectives in the key petroleum producing regions.

For exemplary accomplishment of the party's and government's targets, the highest order--the Order of Lenin--has been awarded to 10 organizations of the sector. These include Azneft' [Azerbaydzhan Petroleum Production Association], Grozneft' [Groznyy Petroleum Production Association], Bashneft' [Bashkir Petroleum Production Association], Tatneft' [Tatar Petroleum Production Association imeni V. D. Shashin], and Glavtyumenneftegaz [Main Tyumen' Petroleum and Gas Administration].

Tens of thousands of sector workers, whose selfless labor accounts for the vigorous progressive development of the petroleum industry during the years of Soviet rule, have been awarded medals and orders. More than 100 of the best of the best among them have been given the high title Hero of Socialist Labor.

With the rise and development of the Soviet petroleum industry, the workers' living conditions have changed. The cities of the older petroleum centers of the country--Baku and Groznyy--have been completely transformed. Modern

cities have grown up in the Ural-Volga area--Oktyabr'skiy, Neftekamsk, Al'met'yevsk, Leninogorsk, and many others. Also being built are nicely laid-out cities in newer petroleum regions of Western Siberia, Mangyshlak, and Northern Komi ASSR. These include Nizhnevartovsk, Surgut and Nefteyugansk, Shevchenko and Uzen', Usinsk, and others.

Now, when we enter any petroleum region, we see well-appointed buildings, fine streets, kindergartens and nurseries, schools, hospitals, and palaces of culture.

Before the Great October Socialist Revolution, the country did not have any system for training petroleum cadres. You would meet very few certified engineers in the petroleum fields.

Only with the establishment of Soviet rule was the training of cadres for the petroleum industry placed on a scientific basis. Thanks to the constant concern of the CPSU and the Soviet government and the attention paid to developing higher and secondary specialized education, the training of petroleum specialists was begun.

In September 1918 a decree was issued concerning the organization of the Moscow Mining Academy, the opening of which took place on 12 January 1919.

At present, petroleum industry cadres are being trained in many institutes and tekhnikums of Moscow, Leningrad, Baku, Groznyy, Ufa, Kuybyshev, Ivano-Frankovsk, Tyumen', Ukhta, Al'met'yevsk, Leninogorsk, Oktyabr'sk, Gur'yev, Nebit-Dag, Okha, and others.

The 25th CPSU Congress, proceeding on the basis of a long-term economic strategy designed to constantly raise the people's standard of living, mapped out a course of action designed to improve the effectiveness of social production and improve work quality.

A key place in the resolution of this task is assigned to heavy industry, especially its main sectors--fuel, metallurgy, power, chemicals, and others.

In his Accountability Report of the CC CPSU at the 25th CPSU Congress, CC CPSU General Secretary Comrade L. I. Brezhnev remarked: "The core of the party's economic strategy, both for the Tenth Five-Year Plan and the long-term future, is the further strengthening of the country's economic power, the expansion and radical renovation of productive capital, the insuring of a stable balance in the growth of heavy industry--the economy's foundation.

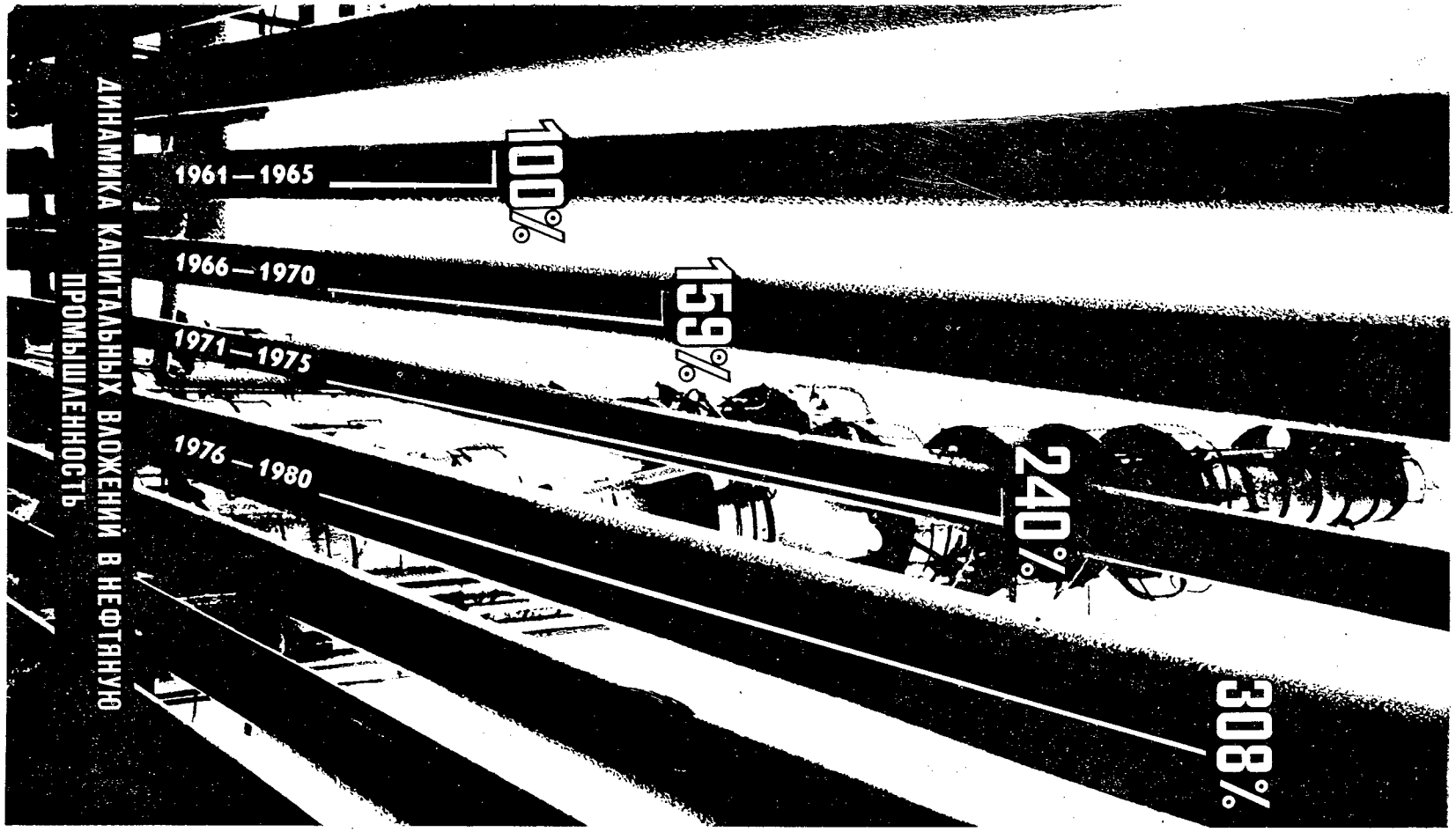
"This presents enormous tasks to the sectors responsible for meeting the country's rising demand for metals, fuel, energy, chemicals, timber, and building materials."

In connection with the large role assigned to the petroleum industry in resolving the tasks of developing the country's fuel-energy and chemical

and petrochemical bases, the 25th CPSU Congress mapped out ambitious tasks. By the end of the Tenth Five-Year Plan, the level of petroleum production, including gas condensate, is to be raised to 620--640 million tons per year; this means increasing petroleum production by 130--150 million tons in one five-year period.

The resolution of this task largely depends on further enlarging the capacities of petroleum production in Western Siberia, northern Komi ASSR, and other regions.

In Western Siberia it will be necessary to put dozens of new fields into production. Resolving all of these problems involved in the further acceleration of this region's development--and they are considerable--will require intensive, well-organized efforts on the part of petroleum workers, geologists, builders, power engineering workers, transport workers, and others.



Dynamics of Capital Investments in the Petroleum Industry

In the five-year period, new, powerful petroleum and gas production and transport facilities are to be built there, along with gas refining facilities, power transmission lines, highways and railroads, dock facilities, airports, housing developments, and cultural-service facilities.

Worker collectives in that severe region have achieved great success as they approach the 60th anniversary of Great October. Drillers and production workers are overfulfilling socialist obligations they have adopted for the year. Millions of tons of above-plan Siberian petroleum have been fed into the country's refineries.

While focusing due attention on the development of Western Siberia as well as other promising regions for increasing petroleum production during the Tenth Five-Year Plan, however, it is essential that the other regions maintain production at a high level.

Experience along these lines has been accumulated by petroleum workers in Tataria, Bashkiria, Kuybyshevskaya Oblast, and a number of other areas. It involves accelerated operational introduction of small deposits, the treatment of strata with various reagents, strict control over field operation, regulation of the working of the deposits, reduced well idleness, and highly-organized current and capital repairs.

A vital and complex problem in the development of the petroleum industry in the next few years is the task of raising the petroleum yield coefficient.

In the sphere of improving petroleum field exploitation, for example, much has been done over the past 15 to 20 years along lines of developing a scientific approach to the utilization of natural petroleum resources. We are extracting more than three-quarters of the petroleum from fields using artificial activation of the strate by injecting water.

However, the results that have been achieved in the exploitation of petroleum fields can no longer satisfy us, because a large portion of the explored reserves is still left in the ground.

Help must come from chemical, thermal, and other methods of activating strata--methods capable of boosting the yield enough to make it comparable to the discovery of new fields.

To resolve this important task, a long term integrated program has been worked out for the industrial adoption of new methods of petroleum extraction. These efforts involve mobilizing scientific and production collectives of the petroleum industry and enlisting scientific institutions of the USSR Academy of Sciences and the VUZ's.

Implementation of this program is being participated in by the Ministry of Petroleum Refining and Petrochemical Industry, the Ministry of Chemical Industry, the Ministry of Petroleum and Chemical Machine Building, the

Ministry of Instrument Making, Automation Equipment, and Control Systems, and a number of others.

Ascribing special attention to the further improvement of the utilization of petroleum resources in the country, the CPSU and the Soviet government have allocated substantial material and financial resources to accomplish this program.

The formulation and implementation of such large scale long term programs testify to the growing capabilities of the economy of developed socialism; they constitute the vital advantage of a planned system of economy.

As was mentioned above, the production of petroleum and gas condensate in our country now exceeds 500 million tons. The Soviet Union is the world's only industrially developed state which bases the growth of its economy wholly on its own fuel-energy resources.

It is necessary to point out the fundamentally important fact that the quantitative growth in petroleum production in recent years has been accompanied by profound qualitative changes which are reflected in the ever-increasing degree of automation of our production operations and the creation of automated control systems.

By now, the sector has fully autmated 166 RITS's [regional engineering-technological services], involving 36,000 wells accounting for more than 75 percent of petroleum production. By the end of 1977, another 22 RITS's will be fully automated.

Implementation of the full automation program made it possible during the Ninth Five-Year Plan to undertake the development of automated systems on different levels of administration.

The first phases of 52 ASU's [automated control system] have been put into operation in the sector, including one sector-level ASU, eight ASU in production associations (Tatneft' imeni V. D. Shasin, Bashneft', Kuybyshevneft', Azneft', Kaspmorneft' [Caspian Sea Petroleum Production Association], and Glavtyumenneftegaz), and two ASU's in the Druzhba and Black Sea long-distance petroleum pipeline administrations.

Implementation of the master program of full automation as well as a number of organizational measures have helped to improve the effectiveness of petroleum production.

Before the end of the current five-year plan, the number of fully automated petroleum and gas production RITS's must be increased to 270; this will make it possible to accomplish the directive of the 25th CPSU Congress with respect to technical progress in the sector in that area.

In addition, it is essential to make qualitative changes in the work of ASU's--to convert from the gathering of information (records and reports) on the activities of various production facilities to the resolution of tasks of forecasting and optimalization. Only in this way will it be possible to achieve more effective administration of the whole complex operation of the petroleum industry.

From the devastated petroleum fields with their primitive technologies in the past to today's automated production--this is the path that the sector has traveled in this short span of history.

These achievements of scientific-technical progress graphically demonstrate the vital power of scientific development on the basis of state plans.

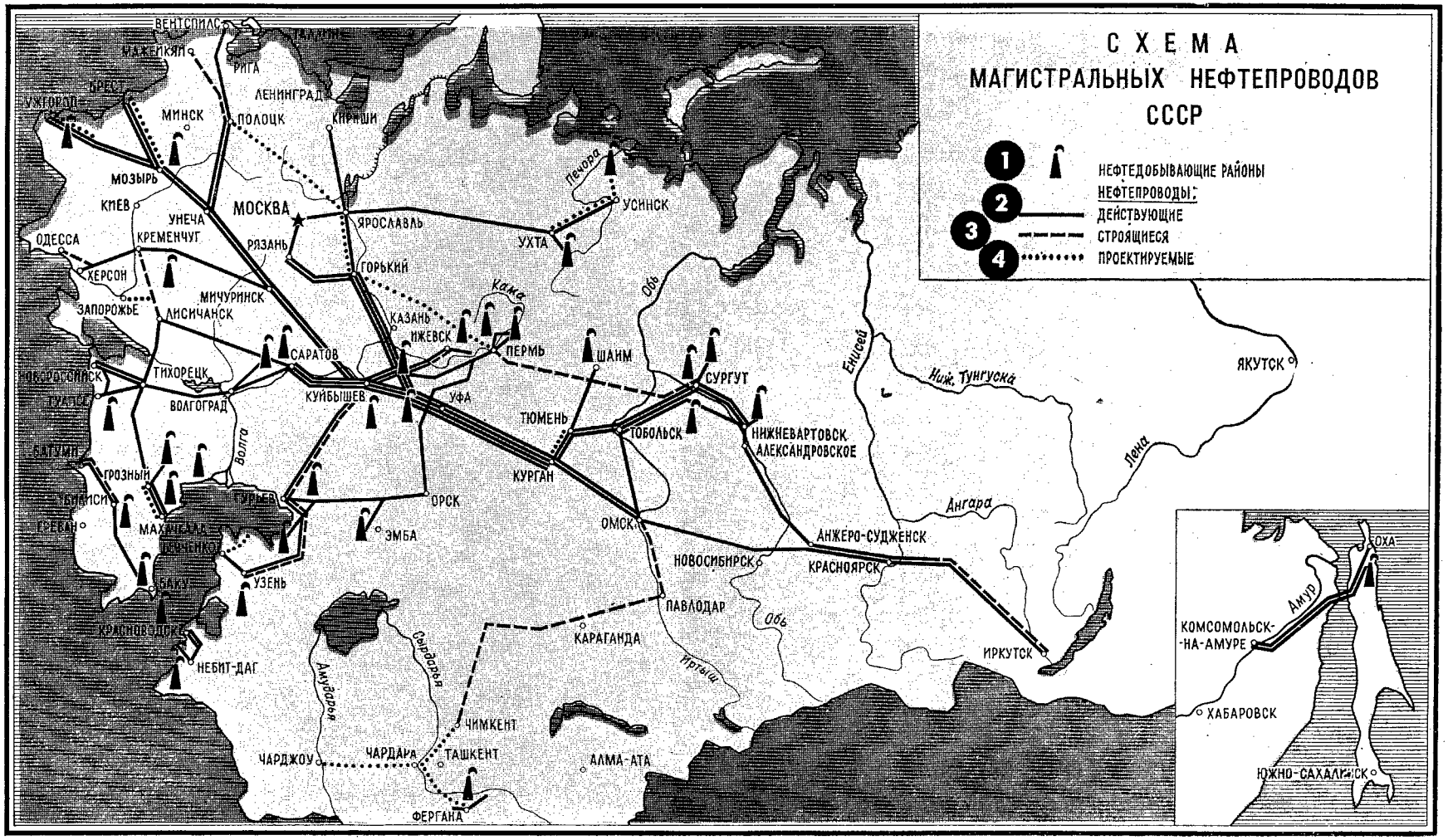


Diagram of Long-Distance Petroleum Pipelines of the USSR
1--Petroleum producing regions pipelines: 2--Existing 3--Under construction
4--Planned

The Ministry of Petroleum Industry system employs the creative efforts of 28 scientific-research and planning institutes. Of them, 11 specialize in particular sector scientific problems; the others, which are planning-research institutes, are subordinate to the production associations in major regions and resolve chiefly local problems.

Following the directives of the 25th CPSU Congress concerning improved effectiveness and quality in scientific research, the Ministry of Petroleum Industry has assigned to the specialized sector institutes the responsibility for selecting the main directions in technical development and determining the research thematics of the institutes of the sector with regard to the most important problems, also for high-quality implementation of the thematics.

These timely measures are making it possible to reconcile sector-wide problems with the content of the work of the territorial institutes, to increase responsibility for the scientific quality and the results of the research, to eliminate instances of unjustified duplication in thematics, to speed up solutions to urgent problems, and to a substantial extent to strengthen ties between the institutes and production. The first results have been positive, but they are only the beginning.

At the same time, petroleum workers ascribe great importance to the prompt application of research findings. "The practical adoption of new scientific ideas is today a task of no less importance than the development of such ideas," remarked L. I. Brezhnev in the Accountability Report of the CC CPSU to the 25th CPSU Congress.

We are resolving this task in collaboration with the machine builders, because we believe that close interaction should exist in the development of production technology and the creation of technical means appropriate to it. In this regard, however, all is not well. Petroleum workers' plans with respect to the adoption of advanced technology must be backed up by the development of new equipment; unfortunately, the machine builders do not always do this willingly, and for this reason progressive technological applications in our institutes frequently grow obsolete while awaiting the production of appropriate equipment. The same thing is true of the production of extremely important goods by the Ministry of Ferrous Metallurgy, the Ministry of Chemical Industry, and other ministries.

In addition, petroleum workers are not satisfied by the quality and reliability of the equipment, pipes, and chemical reagents being delivered; this is resulting in production losses, accidents and complications; well drilling is proceeding too slowly, and operations costs are going up. If we can improve the quality and reliability of performance of pumps, rods, pipes, drill bits, and other underground and above-ground equipment for the petroleum industry, the need for it will undoubtedly decline and it will not be necessary to put new machine building facilities into production.

All of these acute problems must be solved promptly, because during the Tenth Five-Year Plan the petroleum workers are to continue to boost production at a rapid pace; this will require putting many new fields into production, drilling tens of thousands of wells, and substantially improving the effectiveness of main and auxiliary facilities.

The sector's workers are focusing special attention on the problem of reducing casing head gas losses.

This task was set forth by the 25th CPSU Congress. In order to increase the recovery of casing head gas, construction has begun on large-scale gas refineries and pipelines, especially in the new petroleum regions.

In the past five years, with the introduction of the Groznyy, the Kazakh, the Perm', and the Belorussian gas refineries, and two refineries in Nizhnevartovsk, it has been possible to increase gas recovery somewhat. This year, gas refining capacity will rise by 2.5 billion cubic meters when refineries go into operation in Western Siberia and the Kazakh refinery is enlarged.

As a result, for the 1973-1977 period the capacity of the gas refineries will double; this will make it possible to raise gas utilization to 67 percent or more.

But these are just the first steps in resolving this vital economic problem. At the 25th CPSU Congress, our collective was assigned a specific task--that of boosting the utilization of casing head gas to 43--45 billion cubic meters per year; the resolution of this task will largely depend on putting new refining facilities into production and building product and gas pipelines in Western Siberia, Kazakhstan, and other areas.

The main thrust in the building of gas refinery facilities must be the use of units and equipment of large unit capacity, block equipment components, and light-weight structural elements.

We also have another task which is directly stipulated in the decisions of the 25th CPSU Congress--that of boosting the effectiveness of drilling operations and reducing well construction timetables by 25 to 30 percent. In implementing this directive, drilling workers have set specific goals for themselves and mobilized drilling organization collectives to achieve them. As a result, in 1980 the time it takes to build a well should be reduced by an average of 25 days throughout the sector.

At the same time, sector workers will accomplish accelerated technical retooling of production, improved economic effectiveness in prospecting and exploration work, and better development of geophysical research in order to accelerate the preparation of new areas for exploratory drilling.

As in the past, we will accomplish these tasks by raising all the equipment and technology of the petroleum industry to a qualitatively new level.

At the same time, we must focus our attention on more than just the problems of equipment of technology.

Of great importance to improving the effectiveness of petroleum production is socialist competition, which is widespread among collectives and enterprises of the petroleum industry for a worthy greeting to the 60th anniversary of the jubilee of the Great October Socialist Revolution.

More than 350 crews in the leading professions, who adopted higher obligations, have already fulfilled the two-year plan of the five-year plan. Among the first to accomplish this were the collectives of drilling crews headed by foreman N. Akel'yev (Udmurtneft' [Udmurt Petroleum Production Association]), A. Amanyazov (Turkmenneft'), I. Peresedov (Orenburg'neft), S. Melekhin (Komineft'), D. Nurutdinov (Tatneft' imeni V. D. Shashin), R. Sharipov (Bashneft'), M. Shirokov (Glavtyumenneftegaz), and others.

Keeping in step with the drillers are the collectives of rig installation crews headed by A. Radayev (Kuybyshevneft'), G. Zaripov and N. Tyurin (Komineft'), M. Kandrashev (Orenburgneft'), and many others.

Successful work has been done by current and capital well repair crews headed by foremen A. Khayrullin and V. Medvedev (Bashneft'), I. Tyshkanbayev and SH. Shamekov (Embaneft'), V. Markelov (Sakhalinneft'), and G. Guseynov (Kaspmorneft').

In the vanguard of socialist competition are the glorious collectives of petroleum workers of Glavtyumenneftegaz, Komineft', Udmurtneft', Kuybyshevneft', Orenburgneft', and others.

Petroleum workers are heading toward the 60th anniversary of the jubilee of Great October on the firm foundation that was created in preceding years. There arsenal includes powerful technical means and outstanding experienced highly-qualified cadres who are ready for new labor triumphs in the struggle to achieve high goals in the development of our country's petroleum industry.

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ACHIEVEMENTS, PROBLEMS IN GAS INDUSTRY DEVELOPMENT

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 16-24

[Article by S. A. Orudzhev, Minister of Gas Industry: "The Gas Industry by the 60th Anniversary of Great October"]

[Text] Heading to greet the glorious 60th anniversary of the Great October Socialist Revolution, the workers of the gas industry, along with all the Soviet people, are systematically and purposefully implementing the historic blueprints of the 25th CPSU Congress, the targets of the Tenth Five-Year Plan.

The decisions of the May 1977 Plenum of the CC CPSU, the postulates and conclusions contained in the report of CC CPSU General Secretary Comrade L. I. Brezhnev at that plenum, and nationwide discussion of the draft of the new USSR Constitution were received by workers of the sector with profound inspiration; they evoked in the workers a high upsurge of creative involvement and labor enthusiasm.

In the creation of the material-technical base of communism, the gas industry is assigned a vital role. The sector's success largely determines the effectiveness of all social production and the pace of development of our country's productive forces. The extensive use of gas in the economy makes it possible to more fully intensify and automate production processes, with minimum outlays, to make more effective use of enterprise capacity, and to boost labor productivity and improve product quality. Thus, gas is used to produce 87 percent of the steel, 85 percent of the pig iron, 44 percent of the rolled stock, 61 percent of the cement, and 90 percent of the mineral fertilizer.

More and more gas is being used to meet the household needs of the Soviet people. The level of gassification of cities and urban-type settlements now stands at 69 percent, with 57 percent in rural population centers. More than 165 million Soviet citizens use gas in their homes.

In czarist Russia there was essentially no gas industry in the modern sense. Casing head gas production was quite insignificant; pure gas fields were not exploited at all. The Soviet gas industry actually came into being only after the Great October Socialist Revolution, which launched the systematic development of mineral and raw material resources, including

petroleum and gas. During the pre-war years and the first post-war decade, however, volumes and increases of gas production were low. Radical shifts in the development of the gas industry occurred after the 20th CPSU Congress, which formulated the task of accelerating the growth of petroleum and gas production. A vital organizational measure was implemented in 1956--the gas industry was set apart as an independent sector of the economy and began to develop at a fast pace. From 1956 through 1976, the nationwide production of gas rose from 12 to 321 billion cubic meters. At present, in 13 days we produce as much gas as was produced in all of 1956.

In a historically short time the Soviet Union has made a truly gigantic leap in gas production, emerging in second place in the world after the United States, and in first place in terms of industrial reserves, annual production increases, pipe diameters, and overall length of basic long-distance pipeline systems.

The country has operating such large gas transport systems as the Central, the Ukrainian, the Volga, the Ural, the Central Asia--Center, the Northern Regions of Tyumenskaya Oblast--Ural--Volga--Center, the Medvezh'ye--Punga-Vuktyl--Ukhta--Torzhok--Minsk--Ivatsevichi--Dolina--state boundary and others. The overall length of the long distance pipeline network now stands at 105,000 km; the total capacity of gas pumping units installed on the network comes to more than 10 million kilowatts.

A characteristic feature of the construction of large gas transport mainlines at the present stage is the extensive use of pipes of 1,220 and 1,420 mm, also the fact that working pressure in the pipelines has been raised from 55 to 75 kgf/cm^2; this has made it possible to boost volumes more rapidly and to considerably improve technical-economic indicators in gas transport. In the overall transport network, the proportion of pipes 1,220 and 1,420 mm in diameter stood at 21 percent in 1976; by the end of the five-year plan, this figure should rise to 27 percent.

Qualitative changes have also taken place in the shaping of the pipeline network. From individual transport systems covering local areas a transition has largely been made to an integrated nationwide gas supply system. This system provides flexible, efficient maneuvering of powerful flows of gas; it improve the reliability of supply to consumers and promotes better utilization of production capacities of gas fields and long distance pipelines. Further improvements are along lines of systematic concentration of production and increased unit capacity of production enterprises and long distance transport systems.

It has been possible to achieve accelerated rates of development in the gas industry in recent years as a result of accelerated introduction into industrial exploitation of gas fields in the new intensively developing areas of Western Siberia, Turkmenia, and Orenburgskaya Oblast. As late as 12 years ago these gas producing centers were not even indicated on the country's

economic map. Now they provide about 45 percent of the nation's gas production--that is, as much as the whole country produced in 1967.

A major labor triumph of the collectives of the Ministry of Gas Industry, the Ministry of Construction of Petroleum and Gas Industry Enterprises, the Ministry of Power and Electrification, and the Ministry of Installation and Special Construction Work has been the creation of a large industrial complex for producing and refining natural gas based on the Orenburg Gas Condensate field, which has in essence launched the development of a new, highly effective gas chemical subsector.

Running considerably ahead of timetables is the development and successful operation of two phases of a complex which daily refines more than 95 million cubic meters of gas to produce more than 2,000 tons of elementary sulfur, 5,500 tons of stable gas condensate, and 1,000 tons of a broad fraction of light hydrocarbons--valuable types of raw materials for the chemical and petrochemical industry, including the production of mineral fertilizers.

Making extensive use of the experience of preceding years, production field workers, builders, and installation workers are rapidly putting up a third phase; when it goes into operation in 1978, the total annual capacity of the complex for producing and refining natural gas should reach the projected level of 45 billion cubic meters.

The combined forces of an international collective of builders from Hungary, Bulgaria, the GDR, Poland, Czechoslovakia, and the USSR are involved in building Europe's largest long-distance gas pipeline from Orenburg to the western boundary of the USSR. When it goes into operation, Orenburg gas will begin to fed to the consumers of the CEMA member countries; this will constitute yet one more bright example of the successful implementation of the Master Program of Socialist Economic Integration.

A major contribution to the sector's development has been made by the gas and construction workers of Turkmenia. In a short time they discovered and successfully developed such major and gas condensate fields as the Achakskoye, Gugurtlinskoye, Naipskoye, and Shatlykskoye. There, in searing heat and remoteness from industrial centers they created a huge gas producing region, built dozens of production field structures, laid hundreds of kilometers of underground transport artieries of pipes 1,220 and 1,420 mm diameter, and built highways and comfortable urban-type settlements provided with modern social and cultural-service facilities. Today, the fields of Turkmenia are producing about 170 million cubic meters of natural gas every day; this gas is being sent to the consumers of the most important economic areas of the European territories, including Moscow and Moscow Oblast. This year the volume of natural gas production in Turkmenia will amount to about 60 billion cubic meters--more than 17 percent of the nation's output.

In order to achieve the level of gas production planned for the end of the Tenth Five-Year Plan in the republic (75 billion cubic meters), plans call for stepping up the infrastructure and operational startup of fields located nearby to the major transport artery Central Asia--Center (Bayram-Ali,

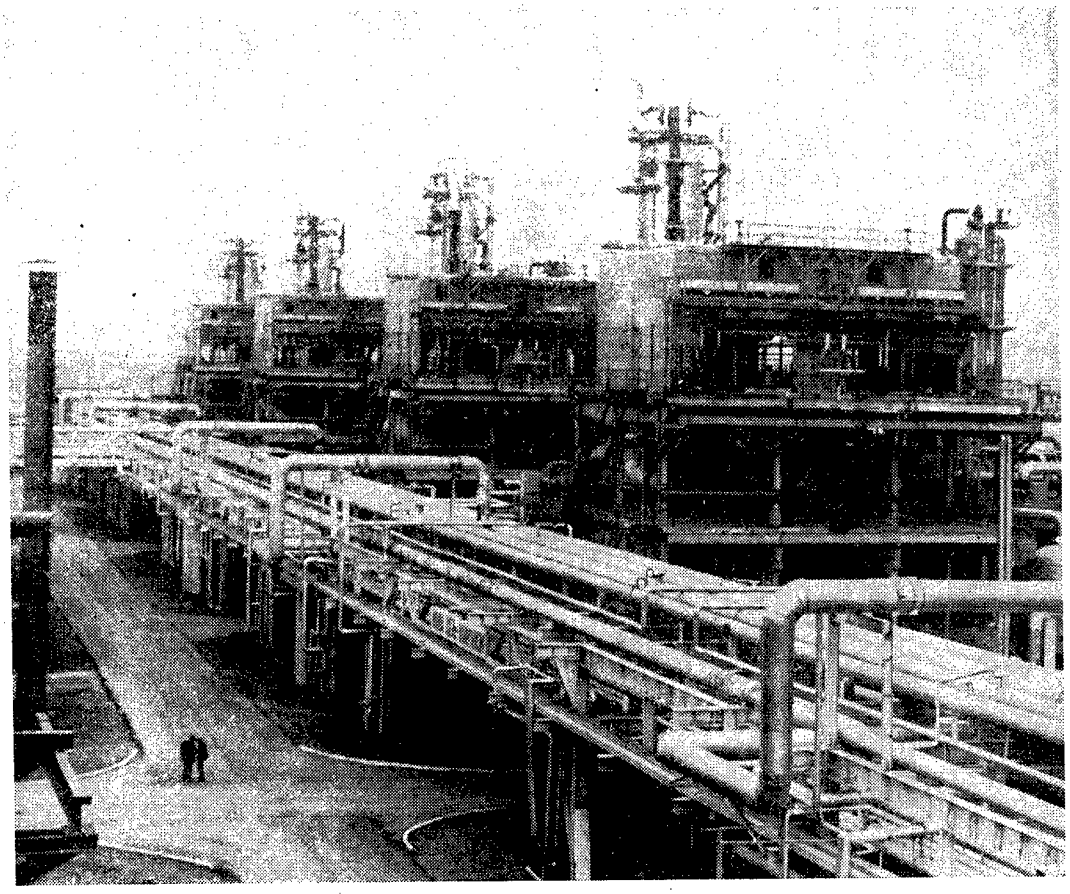
Kirpichli, Tedzhen, Balkui, Beurdeshik, and others); and considering the high promise of this territory in terms of gas potential, plans call for stepping up efforts to find new deposits.

The most important gas producing region, the accelerated development of which is of crucial importance to the sector's development, is Western Siberia. In accordance with the decisions of the 24th and 25th CPSU congresses, work is continuing there on the formation of a huge territorial-production complex to produce and transport gas. Already operating at the Medvezh'ye field, for example, are fully automated complex gas preparation units with unit capacities of 8 to 10 billion cubic meters per year. The entire technological process of gas production is operated by remote control from a central station. A gas industry center is being built and developed in the north--the city of Nadym--in a complex with cultural and service facilities.

In 1976, Western Siberia--a region of severe natural-climatic conditions--produced 44.2 billion cubic meters of natural gas; in 1977, plans call for producing 66 billion cubic meters. Such an annual increase in unprecedented in any other gas producing region. At the end of the Tenth Five-Year Plan, gas production there should increase to 155 billion cubic meters, including 139 billion cubic meters natural gas. In subsequent years its share in the nation's overall output should rise at even faster rates.

Siberian gas should make up for the decline in production in the exploited fields of the Ukraine, the North Caucasus, the Volga area, and Central Asia; it should meet the technology needs of gas-intensive enterprises under construction in the European territories as well as the economy's community and domestic needs, and also export deliveries.

In order to achieve levels of production stipulated for the end of the Tenth Five-Year Plan in Western Siberia, plans call for using the joint forces of the Ministry of Construction of Petroleum and Gas Industry Enterprises, the Ministry of Power and Electrification, and the Ministry of Transport Construction to accomplish large volumes of work in the construction of gas production and transport facilities, power transmission lines, highways and railroads, dock facilities, airports, housing, and cultural and service facilities, and creating maximum comforts for living in the area. In 1977--1980 it will be necessary to put into operation 10 complex gas preparation units with a total capacity of 102 billion cubic meters per year, drill about 620,000 meters, and put more than 530 wells into operation.



Orenburg Gas Complex

For delivering gas from Western Siberia to the central industrial regions of the country, during the Tenth Five-Year Plan three pipeline systems will be built totaling about 18,000 km, of pipes primarily 1,420 mm in diameter: Urengoy--Nadym--Ukhta--Torzhok--Minsk--western boundary of the USSR; Urengoy--Nadym--Punga--Yelets; Urengoy--Surgut--Chelyabinsk--Kuybyshev.

The high concentration of gas reserves in the fields of Western Siberia will make it possible to provide the production increase over the five-year period chiefly from the exploitation of the Medvezhye, Urengoy, and Vyngapurovskoye fields. Their development will be accomplished on the basis of the use of fundamentally new technical-technological applications in the field of well drilling, production, and long distance transport; this will make it possible in a short time to put enormous volumes of gas into economic circulation with minimal capital outlays.

Along with the accelerated development of the gas industry in new areas, much attention is being focused on problems of maintaining present levels of production in the older traditional gas producing areas of the European territories: the Ukraine, the North Caucasus, and the Komi ASSR; this is of great economic and social importance. These areas will introduce new methods of increasing the gas yield coefficient of productive strate (including methods of intensifying the inflow to the bottom hole) and measures designed to make maximum recovery of low-pressure gas; fields with small gas reserves will be put into production.

The Ukraine is the oldest gas producing region. For many years now the Ukrainian gas workers, despite the fact that the base fields in the area have entered the concluding stage of exploitation, have been constantly seeking out additional possibilities for maintaining the present annual level of about 68 billion cubic meters. One of the most important reserves making it possible to maintain this level is the rapid hookup of exploratory wells which produce industrial flows to nearby long distance pipelines.

While giving due credit to the achievements of the workers in the producing regions of Western Siberia, Orenburgskaya Oblast, Turkmenia, and the Ukraine, where present-day development of the gas industry is chiefly centered, we must not fail to mention the labor contribution of the gas workers of Uzbekistan, the Komi ASSR, the North Caucasus and other regions, who are struggling diligently, considering specific conditions, to accomplish the tasks assigned to them.

At the present stage, the gas industry possesses a reliable raw materials base and a powerful production-economic potential. Present achievements create a firm foundation for further effective development of the sector and successful resolution of the grandiose tasks formulated by the 25th CPSU Congress.

By the end of the Tenth Five-Year Plan, the level of gas production should have been increased to 435 billion cubic meters; the increase in 1976--1980 will amount to about 146 billion cubic meters versus the 70.3 and 91.4 billion cubic meters, respectively, achieved in the Eighth and Ninth five-year plans.

During the Tenth Five-Year Plan, gas workers will have to collaborate closely with the Ministry of Construction of Petroleum and Gas Industry Enterprises to put about 35,000 km of long-distance pipelines and more than 250 compessor stations into operation. These difficult tasks will be resolved on the basis of accelerated scientific-technical progress, concentration and consolidation of production facilities, and a higher level of industrialization of facility construction and automation of technological processes.

A chief condition for achieving rapid rates of development in the gas industry is the task of fundamental technical retooling on the basis of the extensive adoption of the latest achievements of science and technology. The Ministry

of Gas Industry has worked out and is implementing a long term integrated program of technical reoutfitting of gas production facilities, long distance pipelines, and compressor stations with new, highly-efficient technological equipment of improved reliability and increased unit capacity, with a high degree of automation, made in the block-set layout, making it possible to extensively adopt industrial methods of construction and thereby to reduce the time it takes to put facilities into operation.

This program calls for the development and adoption of:

new types of special well equipment and gusher fittings providing reliable operation of gas wells in a broad range of variable pressures and temperatures, also under northern conditions and in aggressive environments;

automated block-component complex gas preparation units with productivities of three to five million cubic meters per day per technology line, using highly-effective separation and mass-exchange equipment and cooling turbines. The use of such units makes it possible to boost the level of industrialization of construction and to sharply reduce the amount of time it takes to put facilities into operation as well as labor outlays on the accomplishment of construction-installation work (this is especially vital in building the infrastructure of fields in northern areas) and, in addition, insures the necessary parameters of gas entering the long distance pipelines;

pipes of increased strength (maximum strength 60 kgf/mm^2) with factory-made outside and interior insulation coating, including those designed for use in the northern climatic zone. Increasing maximum pipe strength will yield a metal savings of 10 to 15 percent in the construction of long-distance pipelines, and the use of factory-installed insulation coatings will substantially boost their reliability and service life;

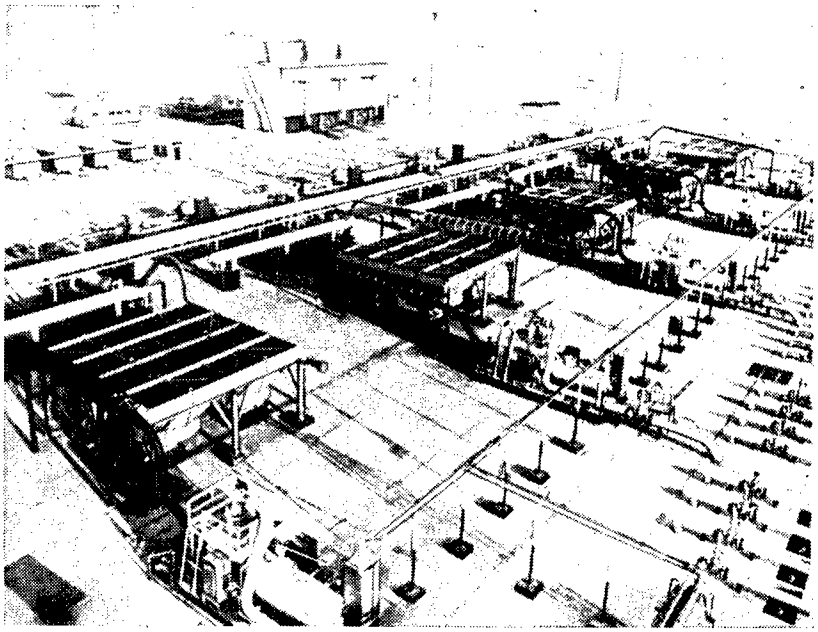
new types of insulation coatings, electrochemical anti-corrosion stations, and machinery and equipment for speeding up the accomplishment of repair and restoration work;

automated block gas pumping units of 6,000, 10,000, 16,000, and 25,000 kilowatts capacity and of increased effectiveness and reliability for installation at zero datum, including units driven by ship's type gas turbines. The use of new gas pumping units will make it possible to reduce compressor station construction timetables by 1.5 to 2 times, to reduce the number of standby units, and to save of fuel gas;

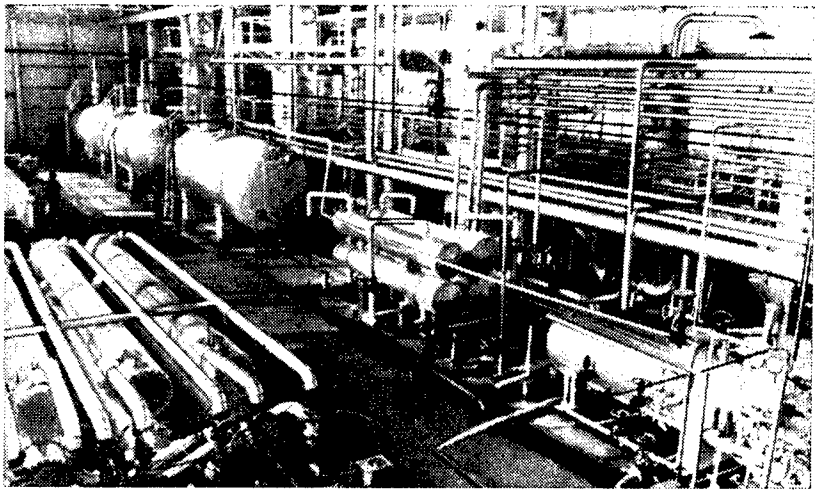
means and systems of integrated automation and remote-control of gas industry facilities.

The implementation of this extremely vital program can be helped by the related ministries supplying gas pumping units, pipes, and other equipment.

Shatlyk. Complex Gas Preparation Unit



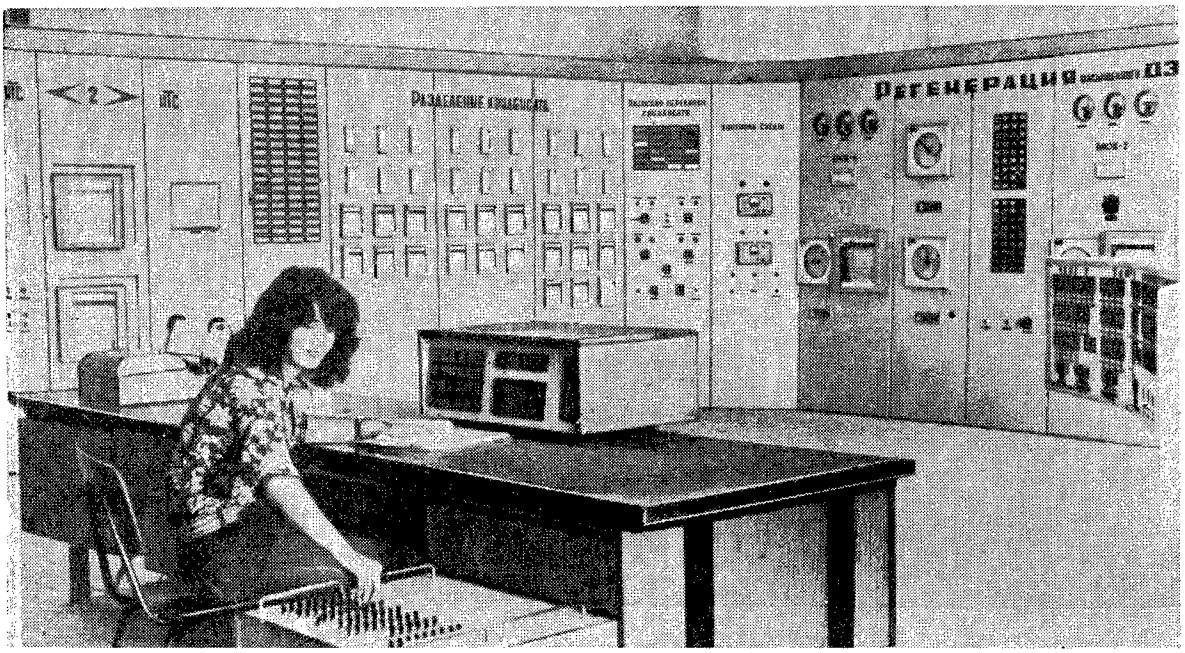
Medvezhe. Gas Preparation Block.



Thus, the Ministry of Chemical and Petroleum Machine Building is supplying large series of block-container gas pumping units with aircraft engine drive of 6,300 kilowatts unit capacity; large-block component equipment with a productivity of three to five million cubic meters per day for complex gas preparation units; gusher fittings of 100 to 150 mm diameter in conjunction with underground well equipment for high-yield wells, made to withstand cold and corrosion. The Ministry of Power Machine Building had begun to supply block basementless gas turbine units of 6,000 kilowatts capacity for compressor stations. The Ministry of Ship Building Industry is manufacturing

the first industrial batch of gas pumping units of 10,000 kilowatts capacity with ships' gas turbine engines characterized by high technical-economic and operating indicators.

Despite the considerable efforts made by adjacent ministries, the development and delivery of more perfected technological equipment for gas industry facilities are not yet being handled satisfactorily.



Shatlyk. Turkmengazprom. Central Control Station Combine with Head Facilities Operating Room. By means of the Impul's-2 remote control system, this station provides control and administration over technological processes in the head facilities and the complex gas preparation units.

The enterprises of the Ministry of Power Machine Building have already made a prototype model of a block basementless gas pumping unit of 16,000 kilowatts unit capacity and are making a unit of even larger capacity. But preparations for series production are proceeding at a slow pace.

In 1978 we hope to be getting improved block gas pumping units with electric drive and 10,000 kilowatts capacity from the Ministry of Power Machine Building and the Ministry of Electrical Equipment Industry.

The use of highly-productive turbine expansion units in gas fields could yield considerable savings, but the Ministry of Chemical and Petroleum Machine Building is moving at a very slow pace in starting up the production of this progressive equipment. Our needs are not being satisfactorily

met with regard to cleaning rod reception and release devices for pipelines of 1,220 and 1,420 mm diameter. The introduction of such devices would make it possible to increase the pipelines' throughput capacity by five to six percent.

The Ministry of Ferrous Metallurgy is moving very slowly in starting up production of large-diameter pipes with increased maximum strength, impact resiliency, and factory-installed outside and interior insulation made of polymer materials. These pipes are extremely essential for building pipelines, especially in the North.

We hope that the related ministries will do everything possible to lay a firm foundation this five-year plan for the full technical retooling of the gas industry with new progressive equipment; this will make it possible to successfully complete the tasks facing the industry with respect to gas production and transport.

During the Tenth Five-Year Plan, special attention is being focused on the building of large gas chemical enterprises handling complex natural gas refining; this will make it possible to utilize all valuable by-products. Plans call for increasing the production of sulfur, ethane, propane, liquified gas, and stable condensate in Orenburgskaya Oblast, Uzbekistan, and the Komi ASSR.

Considering the present scale of gassification and the substantial distances of the raw materials base from the main consumption centers, a much more important role is assigned to stockpiling gas supplies, the only reliable method for which is underground storage. At present we have 25 underground storage facilities with a total reactive gas capacity of 25 billion cubic meters. During the current five-year period, plans call for substantially expanding their network and boosting the total injection capacity to 30 billion cubic meters.

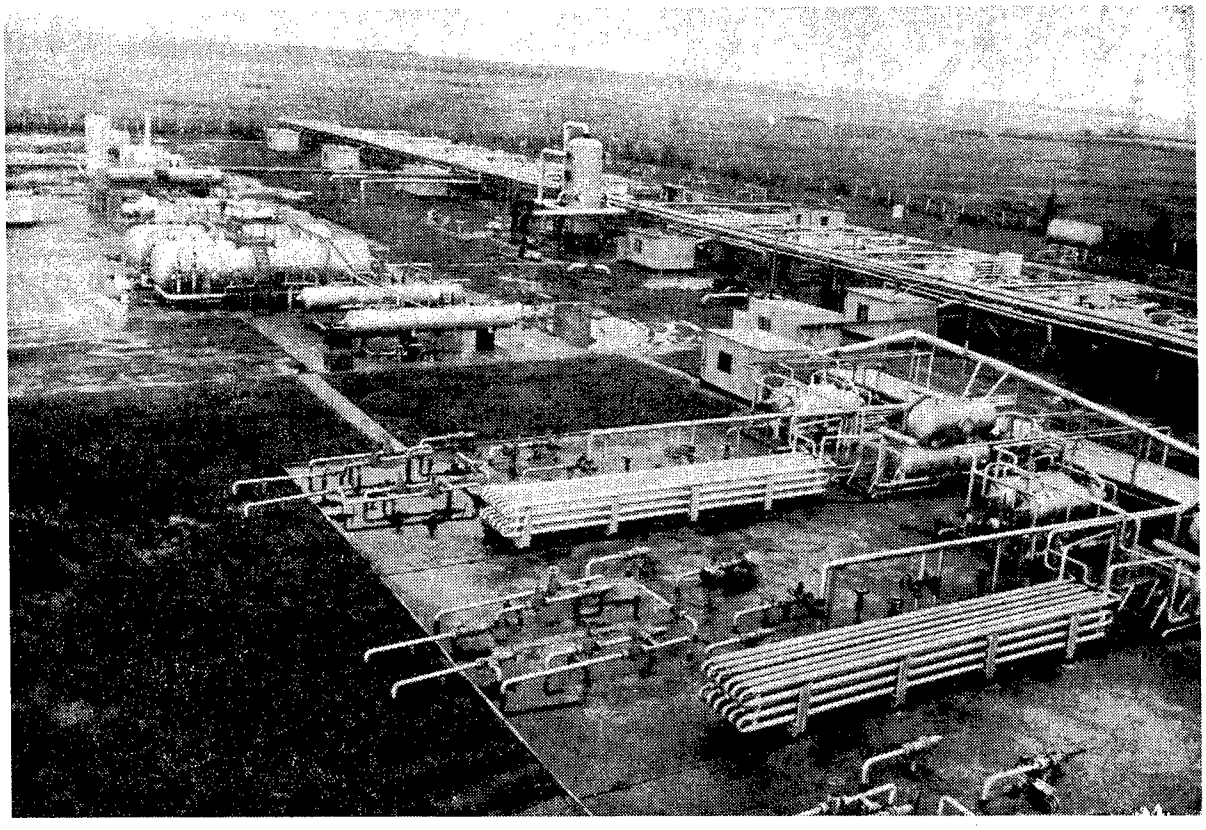
At a time when the party is setting forth the task of comprehensively improving economic effectiveness and quality in all our endeavors, problems of rational gas utilization and compliance with regimes of strict conservation and accounting are taking on exceptionally vital importance.

Over the past decade, because of the shift of the raw materials base of the sector to regions of Western Siberia and Central Asia that are 3,500 to 4,000 km away from the main consumption centers, outlays on gas production and long-distance transport have increased sharply. Now, gas must be viewed as an expensive energy resource, thus requiring high-quality and economical utilization. In many sectors of industry and the community and household sector, however, gas is being consumed wastefully, and existing regulations and rules governing its use are not yielding positive effects.

When gas is used for technological purposes in many sectors of the economy, high economic effects are achieved; at the same time, a large amount of gas

continues to be burned in the combustion chambers of power plants and boiler facilities where the effect is substantially lower. During the Tenth Five-Year Plan, therefore, the groundwork is being laid to insure that in the future our country's power potential is increased primarily through hydroelectric power, nuclear fuel, and cheap coal, and that an increasing amount of gas is channeled into technological requirements. Already in 1976--1980, for example, gas production is to be increased by about 1.5 times, while its use for technological needs is to increase by two times.

It is impossible to operate the nationwide integrated gas supply system in a stable manner without complying with strict gas consumption discipline. Many enterprises are still drawing off gas above stipulated limits; this is leading to substantial difficulties throughout the nation economy, especially during winter cold spells when consumption for heating purposes rises sharply. The Ministry of Gas Industry is implementing a complex of vital organizational-technical measures designed to improve the reliability and stability of the nation's gas supply. But these can be efficacious only if all consumers, without exception, strive to use gas economically.



Krestishchi, Ukrgazprom. Complex Gas Preparation Unit

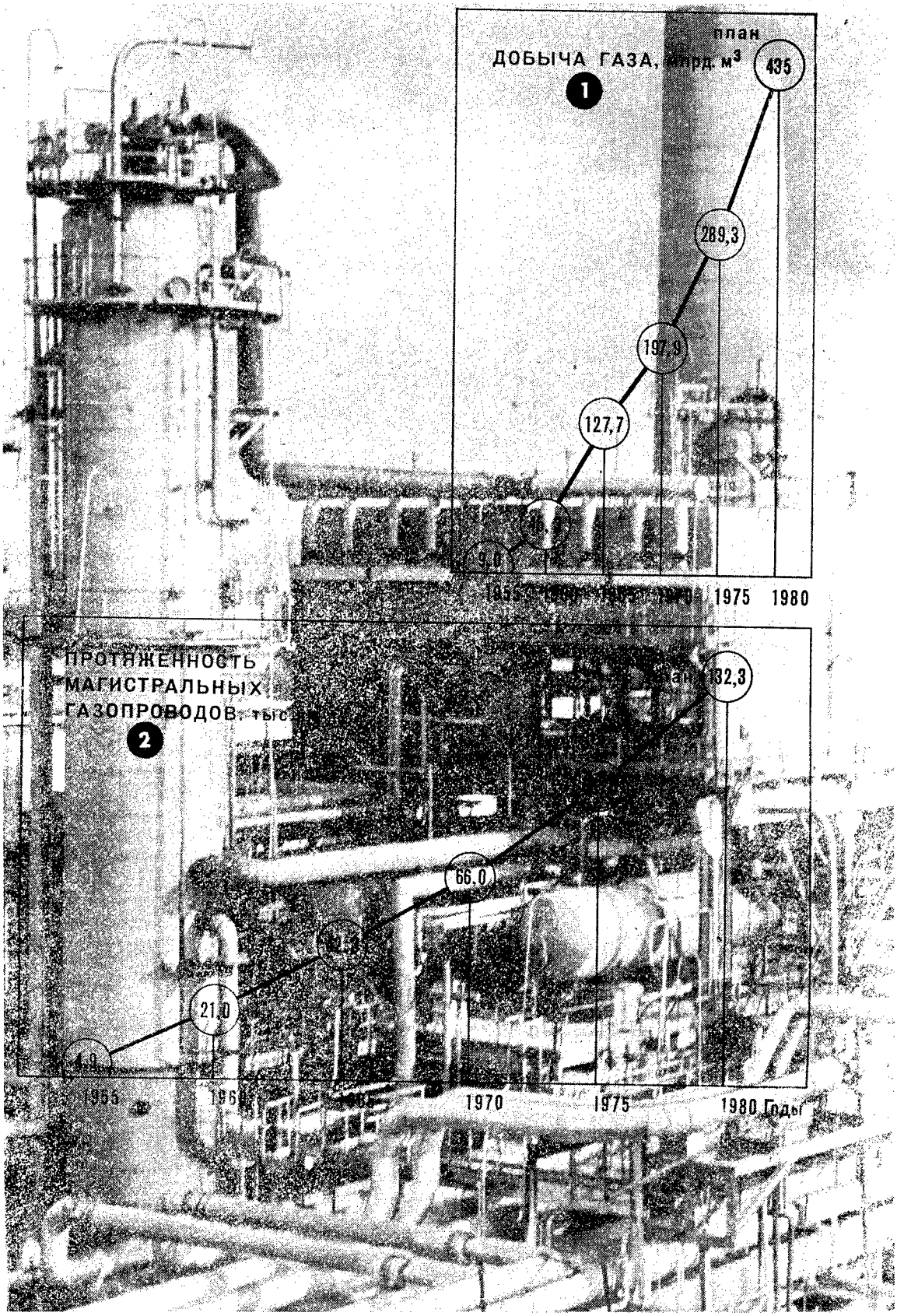
In this jubilee year, the gas industry faces new major tasks in further boosting volumes of production and transport, improving effectiveness and work quality in all economic links. Plans call for boosting the nationwide production level to 342 billion cubic meters, producing about 8 million tons of gas condensate, producing 885,000 tons of sulfur, manufacturing spare parts, equipment, fittings, household gas equipment, and other goods worth a total of 305 million rubles, including 21 million rubles worth of cultural-service items and household applicances.

Striving for a worthy greeting to the 60th anniversary of Great October, workers of the sector are adopting increased socialist obligations: they plan to complete the 1977 national economy plan with respect to gas production, product sales, and other basic indicators ahead of schedule--by 27 December; to produce 6.2 billion cubic meters of natural gas above the plan, including 3.2 billion cubic meters above the plan and additional targets; to produce at least 90 percent of the increase in industrial output through increased labor productivity. In addition, by the jubilee Great October they plan to produce 4.6 billion cubic meters above the plan, including 2.5 billion cubic meters above the plan and additional targets.

Gas workers, along with builders and installation workers of the Ministry of Construction of Petroleum and Gas Industry Enterprises, face a serious task--that of achieving a record daily output of one billion cubic meters. In honor of this glorious milestone in the history of the sector's development, socialist competition has been organized among shifts of operational-production services, as well as services engaged in technological installations and gas compressor stations, for the right to mount the Watch of Honor.

The results of the sector's operation in the first eight months constitute a reliable guarantee of successful completion of plans and obligations for 1977. During that period, the country has been given about 3.8 billion cubic meters above the plan. Compared with the same period last year, the nationwide increase in gas production came to 16.4 billion cubic meters, labor productivity rose by 8.6 percent versus the 5.5 percent stipulated in the annual plan.

Good results have been achieved by collectives of all union industrial associations Orenburggazprom [Orenburg Gas Industry Association], Turkmengazprom [Turkmen Gas Industry Association], Ukrgazprom [Ukrainian Gas Industry Association], and Komigazprom [Komi Gas Industry Association], who have fulfilled the eight-month plan and socialist obligations in honor of the 60th anniversary of Great October. High increases in production have been achieved by the workers of Tyumengazprom [Tyumen' Gas Industry Association].



Key: 1. Gas production, billions of cubic meters
2. Length of long-distance gas pipelines, thousands of km

In the course of organizing socialist competition in honor of the glorious jubilee, the sector has widely disseminated valuable and creative initiatives of the best collectives and production leaders. Thus, the collectives of Orenburgazprom, Uraltransgaz [Ural Gas Transport Association], operations-production service No 5 of Nadymgazprom [Nadym Gas Industry Association], the Kungrad compressor station of Sredaztransgaz [Central Asia Gas Transport Association], and the drilling crew headed by foreman I. Rybchich of Ukrburgaz [Ukrainian Gas Drilling Association] have initiated the adoption of higher socialist obligations in honor of the 60th anniversary of Great October. They have been backed up by all labor collectives in the sector.

About 600 collectives of crews, sections, services, shops, and enterprises have adopted obligations of completing the two-year plan of the five-year plan by 7 November 1977. Drilling crews headed by F. Tikhonov and I. Lysak of Stavropol'gazprom [Stavropol' Gas Industry Association], the drilling equipment repair crew headed by I. Tolstykh of Ukrgazprom, lathe operator A. Glushachenkov and radio installer N. Andrusenko of the Kaliningrad experimental plant of Soyuzgazavtomatika [All-Union Association for Gas Industry Automation] have already completed these obligations and are working on next year.

Examples of a communist attitude toward labor are being set by Hero of Socialist Labor drilling foreman P. Shcheblykin, honored gas industry foreman V. Linichenko, A. Torba, and V. Prostitov, and Ukrainian SSR State Prize Winner operator V. Doroshenko.

Among the Komsomol members and young people working under the slogan "Sixty Shock Work Watches in Honor of the 60th Anniversary of Great October!", excellent work is being done by collectives headed by S. Dakhnenko and B. Khadykin of Orenburgazprom as well as others. Unfortunately, we cannot list all of them.

Workers of the gas industry, implementing the decisions of the 25th CPSU Congress, and the October 1976 and May 1977 plenums of the CC CPSU are bending every effort to insure a worthy greeting to the glorious jubilee of Soviet rule, to successfully complete the targets of 1977 and the five-year plan as a whole and thereby to make a hefty contribution towards strengthening the economic power of our homeland.

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HISTORY, PRESENT DEVELOPMENTS IN PETROLEUM DRILLING

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 24-30

[Article by V. I. Mishchevich, first deputy minister of the petroleum industry: "Drilling Operations in the USSR for 60 Years"]

[Text] In the past 60 years, drilling operations have been transformed from a backward, technically-weak and manual-labor intensive operation into a powerful, highly-equipped sector of the petroleum industry. Thanks to the selfless labor of petroleum workers in the very first years of Soviet rule, the drilling volume of pre-revolutionary Russia was not only reachieved but also substantially surpassed. With its very first steps, the Soviet petroleum industry embarked on the road of technical progress, the adoption of advanced methods of labor and new equipment.

In a short time the rod method of drilling, being the least productive, was replaced with cable and rotary drilling. In 1923-1924, more than 50,000 of 78,090 meters were drilled by the rod method; in 1928-1929, with drilling rising to a total of 320,758 meters, the proportion of rod drilling dropped to less than 0.1 percent. At the same time, the rotary method was used to drill more than 288,000 meters (89.9 percent of the total).

Simultaneously with the adoption of progressive methods of drilling, large scale efforts got underway to build up the Soviet machine building industry. In 1921, GIINmash [State Scientific Research Institute of Petroleum Machinery] was set up to develop new types of petroleum equipment, including drilling equipment; later on it became AzINMASH [Azerbaydzhan Scientific Research Institute of Petroleum Machinery]. All of this served as the basis for the extensive adoption of effective drilling methods, especially rotary. By 1932 95 percent of all drilling was accomplished by this method. And it should be pointed out that the new technical base for rotary drilling was developed by Soviet engineers, whose training was undertaken simultaneously with the development of the Soviet petroleum industry.

The great attention paid by the party and the government to the development of the petroleum industry made it possible in a short time not only to surpass the pre-revolutionary technical level of drilling operations but

also to develop a number of new technical means which went far to determine well known technical applications and further serve as the basis of Soviet drilling development.

In 1925, for the first time in world well drilling practice, use was made of M. A. Kapelyushnikov's single-reduction gear turbo drill. In 1935--1939, engineers P. P. Shumilov, R. A. Ioannesyan, M. G. Gusman, and E. I. Tagiyev developed a multi-stage turbo drill which, in modified form, continues to be the main engine to be the main engine for driving bits into bottom holes. On the basis of this work, after the Great Patriotic War our country extensively developed the turbine drilling method, the proportion of which stands at 76 to 78 percent of the total drilling volume.

The development of our own powerful petroleum machine building industry and the retooling of drilling operations with new equipment using electricity and diesel drive instead of steam machinery opened up broad prospects in the handling of fundamental technological problems and made it possible to achieve high drilling sepeds. The major role in this was played by the above-named petroleum engineers and also M. M. Skvortsov, A. I. Shakhnazarov, V. A. Petrosyan, B. A. Raginskiy, Ya. M. Kershenbaum, S. B. Gozhdayev, M. D. Olovyannyy, A. P. Ostrovskiy, and many others.

Initiators in high speed rotary drilling were the drillers of Azerbaydzhan. In 1946, with drilling down to 1,960 meters, drilling foreman A. I. Orlov achieved a schedule speed of 2,613 meters per rig month and a mechanical speed of 10 meters per hour. Soon after came the records set by drilling foreman Sh. Sh. Faktuliyev (3,064 meters per rig month), G. S. Dzhoyev (3,175 meters per rig month), and N. M. Kulikov, who in 1949 achieved a rate of 3,600 meters per rig month in rotary drilling. Successes by leaders in drilling operations made it possible in the 1950's to convert from individual high speed crews to high speed drilling sections and offices.

During that period, on the basis of high speed drilling experience, a large movement for achieving high technical-economic indicators got underway in Bashkiria and Tataria, in Kuybyshevskaya and Permskaya Oblasts.

The Soviet government highly appreciated the achievements of the high speed drilling crews, in 1949-1950 awarding State Prizes to a large group of drilling foremen and petroleum engineers: A. I. Orlov, Ye. S. Dzhoyev, A. S. Khrishchanov, Mamed Veli Mamed Dzhafar-Ogly, Usta Baba Pirmamed, P. Ya. Nikishin, A. T. Shmarev, N. I. Bulkovskiy, M. L. Lalayants, V. Z. Gritsenko, M. A. Potyukayev, and M. M. Rasulov.

After 1950, the center of petroleum industry development shifted to the eastern regions of the European territories. The extensive adoption of turbine drilling, industrial methods of constructing wells, advanced forms of organizing the work, new bit designs, natural water-based drilling mud, modern methods of trouble-shooting, light-weight well designs, and other factors in a relatively short time made it possible for the Ural-Volga region to occupy a leading place in the petroleum producing industry.

On the basis of new equipment developed by petroleum scientists and manufactured in petroleum machine building plants, the eastern petroleum regions produced outstanding records of high speed drilling. Making efficient use of turbo drills and bits developed by VNIIBT [All-Union Scientific Research Institute for Drilling Techniques] and the machine building plants, new BU-75 drilling rigs made by Barrikady, Uralmash-3D, Uralmash-5D, Uralmash-4E, and Uralmash-6E of the Ural Machine Building Plant, and other equipment, leading drilling foremen A. Kh. Valeyev, M. M. Beloglazov, N. I. Makedonov, V. I. Yermakov, D. I. Mikhaylov, and many others set records in schedule drilling speeds.

During this period, the industrial method of well construction was developed for the first time in the world and successfully adopted in the eastern regions. The developers of this method were engineers B. A. Raginskiy, V. D. Shashin, A. G. Shmarev, A. D. Obnosov, V. I. Roshupkin, G. O. Sklovskiy, A. O. Asan-Nuri, S. G. Skrypnik, and others.

The rise in volume of drilling operations was steadily accompanied by an increase in well depths down to 3,000, 4,000, 5,000 meters and more. Between 1938 and 1958, for example, 58 wells of more than 3,000 meters in depth were drilled througout the country; since 1964, 150 to 250 such wells have been completed annually. Great depths have been achieved not only by the growers of Azerbaydzhan and the North Caucasus but also the Ukraine, Central Asia, Kazakhstan, and other areas.

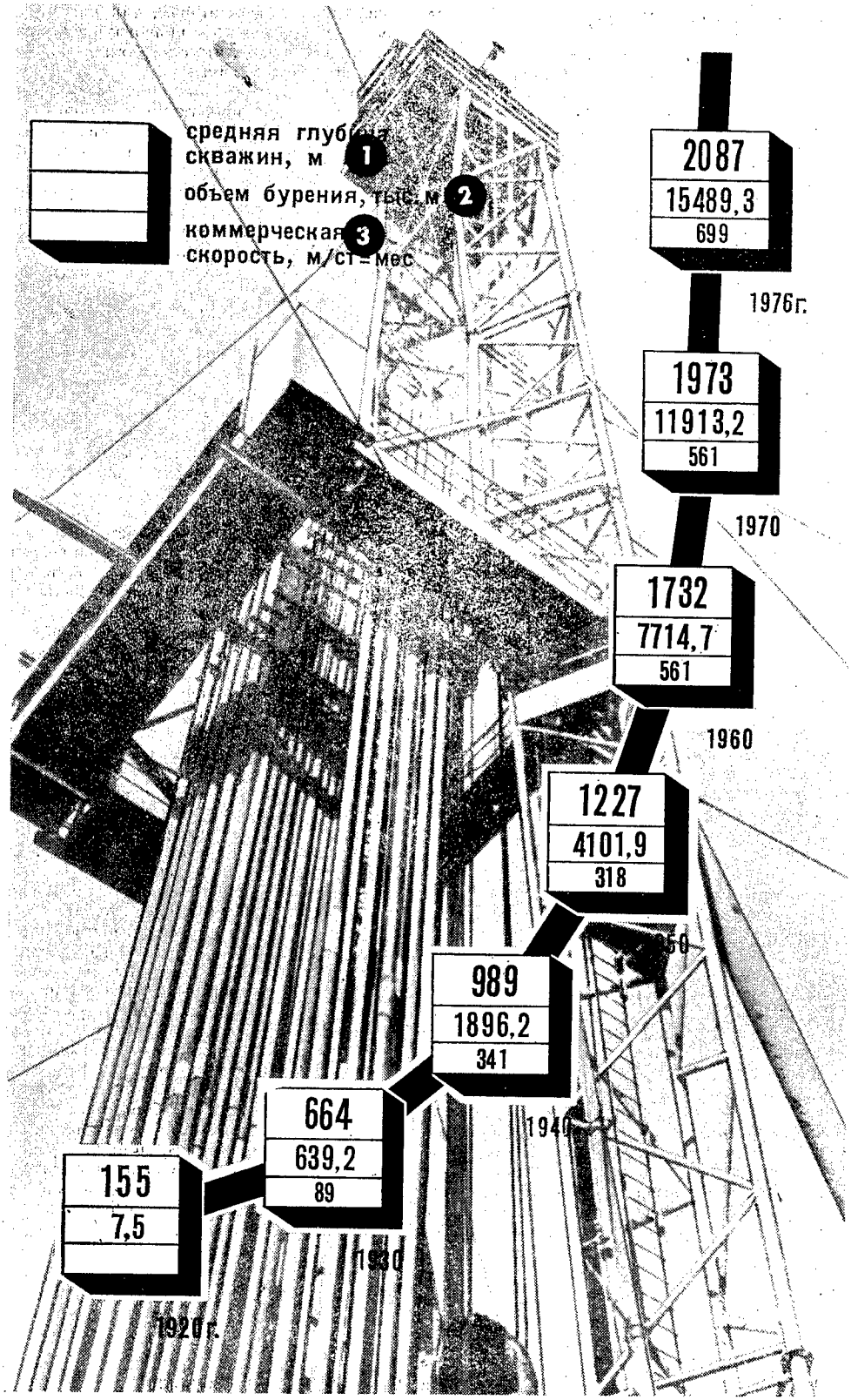
Since the 1960's, drillers have begun to exploit petroleum fields in the northern regions of the country, especially Western Siberia. Extremely difficult climatic conditions, vast swamp lands, severe freezing, and a complete lack of inhabited regions--these are the conditions under which the great Western Siberian petroleum boom began. Resourceful engineering thinking and the drillers' and rig installers' considerable work experience made it possible to turn these conditions to good use--freezing temperatures helped to resolve very difficult problems of organizing drilling operations (the construction of roads and rig footings). From platforms in the middle of swamps they begn to drill not just one well but 6 to 12 wells or more--that is, to build a whole cluster of wells. This method became a major one in the development of drilling operations in Western Siberia. And in an unbelievably short time the drillers managed what had formerly taken decades.

The conquest of the Western Siberian virgin lands wrote new names of drilling workers in the history of the Soviet petroleum industry: V. I. Muravlenko, M. N. Safiullin, V. V. Rekhviashvili, M. I. Sergeyev, A. D. Shakshin, S. F. Yagafarov, G. M. Levin, G. K. Petrov, and many others.

The Soviet Union stands in first place in the world with respect to petroleum production. This is largely due to the sector's drillers. It is difficult to list everyone who has achieved outstanding success in conquering the petroleum virgin lands of Western Siberia and Kazakhstan, the Komi ASSR and Belorussia, boosting production in Tataria and Bashkiria, Permskaya

and Kuybyshevskaya Oblasts, exploring the depths of the earth in Azerbaydzhan and Checheno-Ungushetia, Krasnodar and Stavropol', and other areas of the country.

The constant concern of the party and the government for the development of the petroleum industry, the selfless labor of thousands of drillers, the development of related sectors of the economy which supply equipment for drilling petroleum and gas wells--these have made it possible to step up the construction of petroleum and gas producing facilities and accomplish large amounts of drilling, including in new, uninhabited regions and in increasingly-complex conditions of deeper well drilling. The chart shows the main drilling indicators in the USSR between 1920 and 1976.



1--Average well depth, meters 2--drilling volume, thousands of meters
3--Schedule speed, meters per rig-month

During the Tenth Five-Year Plan, drilling organizations face the task of improving drilling operation effectiveness, achieving a 25 to 30 percent reduction in well construction timetables by increasing drilling speeds, adopting drilling rigs of universal installation capability, new types of bits, bottom hole engines, drilling fluids, high-strength casing and drill pipe, and also through improved organization of the work and the application of advanced methods of well development. The resolution of this task requires a deeper, more integrated approach to the organization of drilling operations, because only by concentrating attention on insuring uninterrupted operation throughout the whole cycle of well construction--especially during the drilling and testing stages--is it possible to deliver wells ready for operation on time. This is main way to improve the effectiveness of capital investments in drilling.

In his Accountability Report to the 25th CPSU Congress, CC CPSU General Secretary Comrade L. I. Brezhnev, analyzing the status and tasks of capital construction, emphasized the necessity of concentrating efforts on priority projects, putting them into operation on schedule, the necessity of changing approaches to the planning and utilization of capital investments (the planning of actual production and new construction as a unified whole, acceleration of construction, economical operations, and a modern technical basis). And since, essentially, every well is a priority project of petroleum producing facilities under construction, drilling organizations must, during construction, proceed on the basis that putting wells into operation on time is the most important task facing the drilling crew, the RITS [Regional Engineering-Technical Service], the TsITS [Central Engineering-Technical Service], and the entire collective of associations and administrations of drilling operations.

During the Eighth and Ninth five-year plans, the Ministry of Petroleum Industry in conjunction with the Ministry of Chemical and Petroleum Machine Building, the Ministry of Heavy and Transport Machine Building, the Ministry of Ferrous Metallurgy, the Ministry of Nonferrous Metallurgy, the Ministry of Chemical Industry, and other ministries and departments did a lot of work to equip the drilling organizations with modern drilling equipment, bottom hole engines, rock-breaking tools, and casing, drill, and pump-compressor pipes. From 1971 through 1976, drilling organizations were outfitted with 35 new designs of rock bits, high-efficiency bottom hole engines, more than 1,750 drilling rigs, and almost 460 sets of heavy equipment carriers to transport rigs in large blocks. The production of drill pipes of the TBVK [expansion unknown] and TBNK [expansion unknown] was organized; these meet the needs of low-RPM drilling; production was stepped up of casing pipes with trapezoidal thread connections of the OTTM [expansion unknown] and OTTG [expansion unknown] type and others.

Substantial success was achieved in mechanizing the mud operations of drilling organizations: base mechanized warehouses were set up to store dry mud materials, also 833 sets of BPR [expansion unknown], 1,294 sets of circulating systems for making up drilling rigs, and up to 130,000 tons of

dry barite weighting compound. Substantial improvements were made in the quality of chemical reagents, and all requirements for bentonite dry mud were fully met.

Increasing the technical equipment level of drilling operations in recent years has provided all the preconditions for accomplishing the tasks assigned by the 25th CPSU Congress to the petroleum industry.

The modern technical base of drilling operations is making it possible this five-year period not only to resolve the tasks of stepping up the pace of well drilling but also of shortening the time required by individual stages of construction and the whole cycle of well construction as the object of unit capacities. In accordance with this, in 1975 the Ministry of Petroleum Industry directed that work on stages of drilling and development (testing) of wells should be accomplished by drilling crew manpower in accordance with a single work order for drilling and development (testing).

An analysis of the work results of the drilling organizations during the Ninth Five-Year Plan showed that achievements in accomplishing the targets of the 24th CPSU Congress with respect to boosting drilling operation profitability became possible on the basis of implementing large-scale measures for retooling drilling operations, improving the structure of drilling operation administration, and adopting new methods of planning and material incentive. These measures made it possible not only to boost the profitability of drilling operations by more than two times (versus a target of 1.5 times) but also to shorten the amount of time required by well construction stages. In the Ninth Five-Year Plan, for example, the amount of time required for rig installation work was reduced by an average of 30 percent per well, drilling operations by 14 percent, and development (testing) by 30 percent.

However, because of the fact that in construction the share of the duration of individual stages came to only 72.3 percent (the rest of the time was spent in waiting for the well development crew, equipment for testing, and so on), reduction in the amount of time required by individual stages did not yield any substantial acceleration of the operational completion of the wells.

Thus, achievements in the work of well drilling organizations revealed reserves in the organization of technological processes of well construction.

On the basis of improved technical equipment levels in drilling operations in well construction in recent years, substantial changes have taken place in crew specialization for the accomplishment of individual stages of construction.

Thus, the adoption of rig components and industrial methods of installation made it possible to do away with narrow specialization in rig construction: instead of crews of diggers, carpenters, concrete workers, and installation workers all rig installation work came to be performed by a single integrated

crew. Thanks to the rising technical equipment level of drilling operations, all preparation and completion work came to be performed by the drilling crew. Well development (testing) operations also came to be specialized, because specific equipment is used for such operations. This work was accomplished by one well development crew.

Crew specialization by stages of well construction played a vital role in improving the effectiveness and speeding up the rate of drilling operations. At the present stage, however, it has become a serious obstacle in speeding up the operational delivery of wells. Considering the dynamic nature of technological drilling processes and the way they depend on geological factors, such specialization has caused interruptions between individual stages. Under specific conditions of nonstationary drilling operations, with the present system of specialization it is practically impossible to insure continuous operation in all stages of well construction, because this requires an additional large amount of equipment and manpower, which from an economic standpoint is inefficient.

It was for these reasons that a decision was made to eliminate, as a first order of business, interruptions in the well construction cycle which have a direct effect on the time it takes to make a well ready for operation.

The adoption of a single work order governing work on drilling and development (testing) by drilling crew manpower does away completely with interruptions in development work while waiting for crews or equipment. Specialized development (test) crews should be used in work aimed at reducing uncompleted construction in drilling and well testing in exploratory drilling involving a large number of test objects. A drilling crew outfitted with highly-productive equipment and modern technology has all the capabilities for achieving high work quality in this vital stage of well construction.

The introduction of the single work order for drilling and development essentially represents the first stage of its adoption for the production of all work involved in the whole cycle of well construction. The basis for this will be further technical progress in drilling operations and, especially, the adoption of rigs of universal installation capability, which does away with the necessity of relatively complex rig installation work. Design applications of new rigs scheduled to go into production in 1979-1980 involve the necessity only of primary installation of the whole rig. Moving rigs further from one construction point to another boils down in practice only to the dismantling, transporting, and assembling of blocks at the new place in a definite sequence.

Along with measures designed to improve the organization of drilling operations, much attention is being focused on improving their technical base. Without this it is impossible to further step up the pace of drilling operations while maintaining high quality and the necessary level of economic effectiveness. At the present time, therefore, large scale measures are underway to improve rock breaking tools, bottom hole engines, petroleum pipe, mud operations, and so on.

In the jubilee year of the 60th Anniversary of Soviet Rule, petroleum drillers are confidently marching toward new labor triumphs, responding with their selfless labor to the party's and government's concern for the well being of the Soviet people.

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HISTORY, PRESENT ACHIEVEMENTS IN PETROLEUM CADRE TRAINING

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 31-34

[Article by A. M. Zhdanov, deputy minister of the petroleum industry: "Petroleum Industry Cadres"]

[Text] The whole history of the rise and development of the petroleum industry is inseparably linked to the heroic struggle of the petroleum workers--the workers and engineering-technical personnel--for steady growth in this most important sector of the national economy. Petroleum workers have always been in the front ranks of the working class, and they enjoy the well-deserved respect of the Soviet people.

The imperialist and then the civil war undermined the foundations of the petroleum industry. As S. M. Kirov put it, it represented a kind of "petroleum graveyard."

After the petroleum industry was nationalized in 1918 through 1920, the petroleum regions were consolidated and transferred to the jurisdiction of Glavneftekom [Main Petroleum Commissariat], the statute for which was approved on 17 May 1918. At that time, the petroleum industry employed 1,811 engineers and technicians, including 1,232 in Azerbaydzhan, 345 in Groznyy, 62 in the Ural-Emba region, 14 in the Temir petroleum fields, and 12 in the Volga petroleum fields.

In response to the call of the Communist Party and under its direction, the working class and the specialists undertook the work of restoration diligently and with extraordinary heroism. By 1928-1929 (the beginning of the First Five-Year Plan), Azerbaydzhan's petroleum industry was one of the first sectors in the nation's industry to basically complete the job of technical rebuilding.

Great tasks in the further development of the petroleum industry were set forth in the First Five-Year Plan (1928-1932). During that period there was the especially acute problem of supplying specialists to the industry. By decisions of plenums of the CC VKP(b) [All-Union Communist Party (Bolsheviks)] dated 12 July 1928 and 19 November 1929, the party drew up the

task of not only increasing the number of Soviet specialists but also substantially raising their level of training, so that they would have adequate, in-depth specialized technical and economic knowledge and a broad social-political viewpoint and qualities that are necessary for production organizers, so that the Soviet state could rely on these cadres in the ambitious job of the building of socialism. This required expanding a network of VTUZ's [higher technical educational establishments] of a new type with sharply delineated specialization in the particular sector of industry.

In czarist Russia, there was no well-organized system of petroleum cadre training. Only with the establishment of Soviet rule was cadre training placed on a scientific basis. At the initiative of V. I. Lenin, measures were mapped out to supply the petroleum industry with trained cadres of qualified engineers and technicians. In September 1918, a decree was issued for the organization of the Moscow Mining Academy. In December 1920, the Azerbaydzhan polytechnical institute was opened on the basis of the Baku technical school--it was the first VUZ in the country set up to train specialists for the petroleum industry. The 16th Congress of the VKP(b) (1930) noted that the essential precondition for completion of the five-year plan was the cadre problem. This required decisive and dramatic efforts to expand and improve the quality of practical work in the field of training industrial cadres and upgrading their qualifications. The congress set forth the task of training specialist cadres from among the working class so that in the next few years the working class nucleus would amount to at least 70 percent of the total school enrollment.

In 1931, petroleum specialists were being trained in three petroleum institutes--Azerbaydzhan, Moscow, and Groznyy, also 11 tekhnikums. By the end of 1931, the number of students stood at 7,992 in the institutes and 3,920 in the tekhnikums. The adopted measures substantially improved the training of petroleum specialists, as evidenced by comparative data given in Table 1 concerning the number of engineers and technicians working in the petroleum industry as of 1 December 1938 and 1 January 1941.

Table 1

Таблица 1

Специалисты (1)	Год (2) 1938	1941
(3) С высшим образованием	4324	9479
(4) Со средним специальным образованием	3404	4433

Key:
1. Specialists
2. Year
3. With higher education
4. With secondary specialized education

Increasing the supply of specialists to the petroleum industry helped to boost production output. Thus, by the beginning of the Great Patriotic War it had risen by 2.9 times compraed with 1913 and by 7.6 times compared with 1920.

In 1942, when German-fascist troops threatened to occupy the petroleum fields of Maykop and Groznyy, 17,486 persons were evacuated from these regions by decision of the State Defense Committee, including 1,354 management and engineering-technical personnel; they were sent to the eastern and central Asian regions, thus substantially strengthening the cadres of the petroleum enterprises and boosting production in those regions. In connection with the fact that drilling was halted on the Apsheron peninsula during the Great Patriotic War, at the call of the Communist Party a large number of petroleum specialists went to the east and to Central Asia; they launched the beginning of the exploration, drilling, and industrial exploitation of petroleum and gas fields in the country's eastern regions.

Large numbers of petroleum specialists were in the front lines during the Patriotic War. For this reason, the number of specialists working in the petroleum industry declined somewhat during the war years despite the graduation of engineers and technicians (Table 2, data as of 1 January).

Table 2

Специалисты (1)	Год (2)		
	1943	1944	1945
С высшим образованием (3)	5581	6404	8595
Со средним специальным образованием (4)	4089	4072	5038

Key:
1. Specialists
2. Year
3. With higher education
4. With secondary specialized education

Compared with 1 January 1941, the number of specialists as of 1 January 1943 had declined by 31 percent; as of 1 January 1944--by 25 percent. And only on 1 January 1945 did the number of specialists reach 98 percent of the pre-war level.

During the post-war period, in connection with the restoration and development of the petroleum industry, there was a substantial increase in the number of students and graduate students in the educational institutions. At the beginning of the 1945-1946 school year, petroleum VUZ's and tekhnikums were training 12, 506 persons. In connection with the growth of the student enrollment, there was an increase in the number of specialists graduated by educational establishments and the number of engineers and technicians

entering the petroleum industry. In 1951-1955 alone, higher and secondary specialized educational institutions sent 26,296 specialists into the enterprises of the Ministry of Petroleum Industry (Table 3, data as of 1 January).

Table 3

(1) Специалисты	Год (2)			
	1950	1952	1954	1956
С высшим образованием (3)	12 209	15 585	20 100	22 095
Со средним специальным образованием (4)	10 952	15 854	19 223	21 555

Key:
1. Specialists
2. Year
3. With higher education
4. With secondary specialized education

The post-war years are characterized by especially rapid development of the petroleum industry. It was during this period that the decisions of the 17th and 18th VKP(b) congresses came to be fully implemented with respect to building up a second petroleum base in areas between the Volga and the Ural.

Substantial help in the development and exploitation of new petroleum fields in Tataria, Bashkiria, and Kuybyshevskaya Oblast was provided by the petroleum workers of Baku, who sent their best specialists and did a great deal to organize petroleum production and training and share experience with local petroleum cadres. This demonstrated once more the magnificent power of the friendship of the peoples of the Soviet Union and the ideals of socialist internationalism. All of this made it possible to build up a powerful petroleum base in the east.

Between 1950 and 1953, 45,584 of the best workers and engineering-technical personnel were given orders and medals for years of service and selfless labor in the petroleum industry.

In the subsequent period (the Sixth Five-Year Plan and the 1954-1965 Seven-Year Plan), the petroleum industry, now possessing an adequate contingent of specialists, successfully fulfilled petroleum production plans. For completing the seven-year plan and developing the petroleum industry, leading collectives of Tatneft' [Tatar Petroleum Association], Bashneft' [Bashkir Petroleum Association], Kuybyshevneft' [Kuybyshev Petroleum Association], Turkmeneft' [Turkmen Petroleum Association], Permneft' [Perm' Petroleum Association], Sakhalinneft [Sakhalin Petroleum Association], Ukhta Combine, and petroleum field administration imeni XXII S"yezd KPSS were given the Order of Lenin and the Order of Labor Red Banner. For outstanding service in the development of the petroleum industry, 35 enterprise

and organization workers were awarded the titel Hero of Socialist Labor; 3,472 leaders were awarded orders and medals.

The petroleum industry developed especially rapidly during the Eighth and Ninth Five-Year Plans, when new regions were discovered in Western Siberia, Kazakhstan, Belorussia, and Udmurtia.

The development of the sector and the discovery of new regions were accompanied by a systematic rise in the number of specialists. From 1966 through 1975 the total number of specialists in the petroleum industry rose from 56,600 to 154,200, or by 2.7 times, including an increase from 23,200 to 60,700 specialists with a higher education—2.6 times. Moreover, the proportion of specialists among those employed in the sector rose from 11.8 to 20.5 percent, and the average annual increase from 1966 through 1975 amounted to about 10,000 persons, with a fairly steady ratio (1:1.6) of workers with higher and secondary specialized educations.

At present, specialists for the petroleum industry are being trained in seven VUZ's and six departments designated for specialization in the petroleum industry. In 1976, these VUZ's and departments accepted 7,673 students for petroleum specialization, including 4,561 in daytime studies. This training volume is adequate for supplying the petroleum industry with specialists of this profile. Workers with a secondary specialized education in the main petroleum industry jobs are being trained in 21 tekhnikums subordinate to the Ministry of Petroleum Industry and located in all major petroleum producing regions.

Of great importance in the system of engineering-technical cadre training are the correspondence and evening schools, which primarily train people who have practical experience in the petroleum industry. The total VUZ and secondary specialized educational establishment enrollment of students remaining on the job amounts to about 40 percent of the total number of students and graduate students.

The availability of a large army of qualified specialists of various profiled made it possible to successfully complete the targets of the Eighth and Ninth Five-Year Plans with respect to petroleum production.

Substantial work has been done to supply qualified cadres to new petroleum producing regions. In Glavtyumenneftegaz [Main Tyumen' Petroleum and Gas Administration], for example, the number of specialists rose from 2,009 as of 15 November 1965 to 18,805 as of 1 January 1977, including an increase from 839 to 6,759 having a higher education. These and many other measures made it possible for the petroleum workers of Tyumen' to complete the targets of the Ninth Five-Year Plan ahead of schedule.

The glorious successes achieved by petroleum workers in Western Siberia received high praise at the 25th CPSU Congress.

For outstanding success in the development of the petroleum industry and high production indicators in the fulfillment of planned targets and socialist obligations in the Ninth Five-Year Plan, a Ukase of the Presidium of the USSR Supreme Soviet dated 25 March 1975 awarded the Order of Lenin to Glavtyuemnneftegaz; 531 workers in that administration were given orders and medals of the Soviet Union.

A major contribution to the development of the petroleum industry is being made by scientific workers and scientists in the scientific-research institutes of the Ministry of Petroleum Industry--specialists who have been trained in the VUZ's during the years of Soviet rule.

In 1929, our country built the first scientific-research petroleum geological-exploration institute. At present, the Ministry of Petroleum Industry has 28 geological and petroleum scientific-research institutes in all of the main petroleum producing regions.

In 1927, scientific cadres were trained as probationers and trainees in scientific-research institutes. A probationer studied for one year in the institute, after which he was tested and a decision was made as to whether to enroll him as a trainee. For trainees, the time spent in the institute was set at two years. In all, 26 scientific-research institutes of the VSNKh [Supreme Council of the National Economy] had 172 probationers and 27 trainees in 1927. In 1942, when scientific cadres were being trained in graduate studies, the acceptance plan for that year in the VUZ's of Narkomneft' [People's Commissariat of the Petroleum Industry] was set in the amount of 17 persons.

At present, scientific cadres are being trained in graduate studies affiliated with nine scientific-research institutes of the Ministry of Petroleum Industry as well as in pursuit of the degree of candidate of sciences. The annual acceptance of specialists for graduate study comes to between 100 and 110 persons. As a result of the work done in training scientific cadres, their potential has risen substantially (Table 4).

Table 4

Показатель (1)	Год (2) 1964	1968	1972	1976
(3) Число работающих в институтах Минефтепрома	11 106	13 306	18 837	24 581
(4) в том числе научных работников	4 395	5 309	7 319	9 375
(5) Из них имеют степень				
(6) доктора наук	61	78	102	123
(7) кандидата наук	505	877	1 302	1 794

Key:
1. Indicators
2. Year
3. Number of those employed in institutes of the Ministry of Petroleum Industry
4. Including scientific workers
5. Including:
6. Doctors of science
7. Candidates of science

The profile of doctors of science and key scientists encompasses 31 specialties, including 48 doctors of geological-mineralogical sciences (39.4 percent of the total number of doctors) and 63 doctors of technical science (51.1 percent).

In terms of the technology of field exploitation and economic effectiveness, the USSR holds a leading place in the world. Most of the oil produced is extracted from the ground by means of perimeter and marginal flooding. Most of the wells have been converted to automatic control from central control stations; this makes it possible to maintain operations at optimal regime levels. Many other problems have been worked out by the scientists and, in collaboration with enterprise specialists, adopted in the petroleum industry.

I should like to comment especially on the major role played by women in the development of the petroleum production industry. Soviet rule has not only emancipated women but also opened up great opportunities to them to take active part in the building of a communist society in our country. They are successfully working various sectors of the economy. According to the 1926 census, there were only a handful of women specialists involved in petroleum; at present, the petroleum industry employs 23,971 women with a higher education--39 percent of the total number of specialists.

Women make up 35 to 40 percent of the graduates of specialized institutes and petroleum departments, and 32.6 percent of the tekhnikum graduates.

The number of women with a higher education employed in the petroleum industry rose substantially during the post-war years: 2,680 in 1946, 7,397 in 1957, 8,881 in 1966, and 23,971 in 1975.

There are 4,233 women working in the sector's scientific-research institutes--45 percent of the scientific workers; these include 10 doctors, 347 candidates of science, and 5 professors.

In the last few years, a great amount of work has been done to train national cadres with a higher and secondary specialized education.

In pre-revolutionary Azerbaydzhan, there were only 12 Azerbaydzhan engineers. Now, the petroleum industry employs 4,206 Azerbaydzhan specialists with a higher education and 4,691 with a secondary specialized education.

In connection with the development of petroleum production in Turkmenistan, the republic is building up cadres of native specialists--Turkmens. In 1934, there was only one Turkmen specialist with a higher education working in Nebit-Dag. At present, the republic's enterprises and petroleum industry organizations employ 985 Turkmen specialists, including 369 with a higher education.

Native cadres are also increasing in Kazakhstan. During the first few five-year plans, there were almost no Kazakh engineers; now, most of the engineers in Kazakhstan's industry are Kazakhs. The republic's industry employs 1,116 Kazakh specialists with a higher education and 1,370 with a secondary specialized education.

The country's petroleum industry employs specialists of 38 nationalities having a higher education and 42 nationalities having a secondary specialized education.

The flowering of the Soviet petroleum industry after the victory of the Great October Socialist Revolution serves as a brilliant example of the enormous creative efforts of the Communist Party, the Soviet government, and all of our people.

The country's petroleum workers face new, substantial, complicated tasks. It is essential to meet the economy's rising demand for high-quality petroleum and raw materials for chemistry.

The glorious detachment of workers, engineering-technical personnel, and employees in the petroleum industry are exerting every effort to honorably justify the trust placed in them by the Communist Party and the Soviet government and to successfully complete the targets of the Tenth Five-Year Plan with respect to petroleum and casing head gas production.

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UDC 338.45:[622.276+665.6](103)

CEMA PROGRESS, PLANS IN PETROLEUM, GAS COOPERATION

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 35-37

[Article by D. A. Takoyev, deputy minister of the petroleum industry: "The Petroleum Industry in Collaboration With the CEMA Member Countries"]

[Text] In the course of the past three decades, the Soviet Union has been providing fraternal aid to the countries of the socialist commonwealth in their industrialization through the construction of various industrial enterprises and deliveries of fuel that is scarce in the world markets (especially hydrocarbons), raw materials, supplies, and substantial amounts of equipment. With the participation of the Soviet Union, the socialist countries have built and are building a total of about 3,000 projects in the post-war years.

The rapid rise of the industrial potential of the CEMA member countries requires solutions to the problem of supplying the national economy with fuel and raw materials. Until 1975, the CEMA countries' petroleum needs were completely met by deliveries from the USSR, which helped in the building of new production facilities and whole sectors of industry in these countries.

During the years the world socialist system has been in existence, a world socialist market has developed; production and scientific-technical cooperation has been extensively developed by the socialist countries. A specific manifestation of the growing economic consolidation of the socialist countries in the field of petroleum industry was the construction, through the joint efforts of five countries--the USSR, Hungary, Poland, the GDR, and Czechoslovakia--of the trans-European Druzhba petroleum pipeline, which has carried hundreds of millions of tons of petroleum in the 15 years of its existence, and also petroleum producing enterprises and a refining industry. Large petrochemical production complexes have been built in the countries which receive Soviet petroleum through the Druzhba pipeline: complexes in Bratislava, Zaluzi (Czechoslovakia), Plock (Poland), Schwedt (GDR), Sazhalombatt (Hungary), and others.

The Master Program of socialist economic integration, adopted in 1971 at the 25th CEMA session, signaled the beginning of a new stage in economic cooperation among CEMA countries. The main principles of socialist economic integration comprise voluntary affiliation and mutual benefits, under which every country simultaneously resolves its own problems and international problems facing the socialist commonwealth. On the one hand, this promotes the economic development of countries participating in such a commonwealth; on the other, it serves to strengthen their economies.

The Master Program, in particular, provides for the following:

extensive cooperation of the interested CEMA members in more intensively boosting their own petroleum and gas production, focusing special attention on stepping up the exploration and exploitation of petroleum and gas fields located at great depths and in off-shore areas;

studies of USSR proposals concerning possible volumes of petroleum and gas exports to CEMA countries for the peak period up to 1980 and terms of cooperation among interested countries in the building of additional facilities within the USSR for the production and transport of petroleum and gas.

Domestic production of petroleum in the European CEMA countries (exclusive of the USSR) in 1970 met 30 percent of their needs; in 1975, it was only 19 percent. Consequently, it is essential to channel specific efforts into the development of petroleum production in those countries.

One way to resolve this problem has been to combine efforts on stepping up the development of petroleum and gas geological-prospecting work. New forms of production and scientific-technical cooperation, recommended by the Master Program, are being used. Geological organizations of the USSR, Poland, the GDR, and Czechoslovakia, are successfully resolving joint tasks within the framework of the agreement "Coordinating Prospecting and Geological-Exploration Work for Petroleum and Gas in Unitary Geological Regions." For carrying out petroleum and gas prospecting and exploration work off-shore in the Baltic Sea, the GDR, Poland, and the USSR have set up the Petrobaltik production organization. Intermorgeo [International Marine Geology] Coordination Centers have undertaken joint research into the problem of optimalizing drilling regimes and processing and storing geophysical information.

Considerable goal-directed work on implementing sections of the Master Program--those relating to the activities of petroleum and gas ministries and departments--is being done by the CEMA Permanent Commission on Petroleum and Gas Industry. The working bodies of this commission are successfully resolving problems of economic and scientific-technical cooperation in the field of petroleum and gas geology and geophysics, equipment and technology for drilling deep wells, petroleum and gas production, transport and storage of hydrocarbons, and petroleum refining. The commission regularly reviews the course of implementation of measures relating to environmental protection.

Joint scientific-research work that has been done in the process of cooperation has created conditions for in-depth studies of petroleum and gas bearing regions and determination of the laws governing the formation and location of petroleum and gas deposits within the CEMA countries. On a unified methodological basis the geological structure of these countries has been pinpointed, and there have been two evaluations of predicted reserves of petroleum and gas.

A scientific-practical conference that was held in October 1976 to discuss the results of petroleum and gas geological-exploration work in the CEMA countries and to map out the tasks for 1976-1980 evaluated joint efforts positively, remarking that from 1966 through 1975 alone more than 150 petroleum and gas deposits were discovered in the CEMA countries (the western regions of the European territories in the case of the USSR).

The conference also noted that the econoimc indicators of petroleum and gas geological-exploration work and the subsequent putting of petroleum and gas resources into production are stipulated in the specifications of the national economies of these countries, and that further development of these efforts are economically justified. It was determined that prospects for discovering new petroleum and gas deposits must be linked chiefly to deep-lying horizons (more than 3.5 to 4 km), also prospecting for pools of the unstructured type. There is definite potential in the off-shore territories of the CEMA countries.

At present it is essential to implement formulated joint recommendations and proposals--especially the development of special technical means on the basis of cooperation and production specialization.

Cooperation among CEMA geologists and petroleum workers has already yielded results. In recent years, for example, new deposits of industrial reserves of petroleum and gas have been discovered in northwest Bulgaria, and the application of advanced methods of exploration has made it possible for Hungarian petroleum workers to substantially boost the quantity of explored reserves of hydrocarbons. Gas fields have been discovered in the GDR and Poland.

Nevertheless, the Soviet Union has been and remains the main base for the development of hydrocarbon fuel resources in the socialist commonwealth. Our country's petroleum industry is steadily boosting petroleum production. At the same time, reduced outlays on petroleum production are rising. This is due primarily to the shift of the centers of the petroleum industry to the more remote eastern regions of the country; this requires substantial increases in the amount of geological-exploration work, the construction and rebuilding of a large number of enterprises, the accelerated production development of new fields.

Under these conditions, the socialist countries face considerable tasks in the further development of bilateral and multi-lateral cooperation.

Considering the rising fuel and raw materials needs of the CEMA countries and the unequal distribution of natural hydrocarbon resources and limited possibilities for increasing petroleum and gas production in these countries, the problem of the development of the fuel-energy and raw materials base is taking on special urgency. It is possible to resolve the problem successfully on the basis of combining the efforts of every one of the CEMA countries and their collective actions.

Among the main trends in the development of the USSR's national economy, special attention is being focused on consolidating the efforts of the CEMA countries for the joint resolution of strategic tasks involved in expanding raw material and fuel-energy bases on the basis of jointly formulated long-term goal directed programs of cooperation.

A bright example of fraternal cooperation among peoples of the socialist countries is the construction of the world's largest international fuel-energy long-distance pipeline between Orenburg and the western boundary of the USSR--a distance of 2,700 km. When this gas pipeline goes into operation at the end of the current five-year plan, the CEMA countries will receive 15.5 billion cubic meters of Orenburg gas per year; this will substantially boost the industrial effectiveness of the socialist countries.

In accordance with signed protocols, the CEMA countries are taking part in the construction of additional facilities in the Soviet Union's petroleum industry between 1976 and 1980 (project planning, deliveries of building materials, supplies, and component sets of technological equipment for their construction, and installation and adjustment and startup work).

Productive cooperation among socialist countries in the petroleum and gas industry guarantees stable, regular deliveries of petroleum and gas at firm prices. This is especially important considering conditions that have developed in the world petroleum market.

At the same time, the 30th CEMA Session, focusing special attention on problems of further boosting petroleum and gas production in the CEMA countries, recommended that in the joint formulation of long-term goal directed cooperative programs in the field of fuel, energy, and raw materials, stipulations be made concerning fuller incorporation of available deposits of solid fuel into economic circulation in these countries (hard and brown coal, lignite, shale, and so on), maximum use of nuclear energy and hydroelectric resources, and accelerated efforts on problems of using new sources of energy.

In the documents of the 25th CPSU Congress, our country's Communist Party, focusing special attention on further strengthening friendship and cooperation between the USSR and the socialist countries, calls for keeping firmly to the tried and tested rule: conduct affairs in the spirit of genuine equality and interest in one another's success, work out decisions which take account not only of national but also international interests. Pointing

up the necessity of implementing the measures stipulated in the Master Program of socialist economic integration, Comrade L. I. Brezhnev at the 25th CPSU Congress remarked that the power and solidarity of the socialist commonwealth are becoming stronger on the path of economic integration.

The USSR's petroleum industry, implementing the decisions of our party, is making a worthy contribution toward the development of the economic base of the socialist commonwealth.

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THE SCIENTIFIC-TECHNICAL SOCIETY'S ROLE IN OIL, GAS PROGRESS

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 37-41

[Article by Yu. V. Zaytsev, chairman of Scientific-Technical Society of the Petroleum and Gas Industry: "The Scientific-Technical Society of the Petroleum and Gas Industry by the 60th Anniversary of Great October"]

[Text] In the successful resolution of the tasks assigned by the CPSU to workers in the petroleum, gas, and petroleum refining industry, a hefty contribution is being made by the scientific-technical society.

The first social scientific-technical organizations appeared in Russia in the 1960's through the 1880's. In 1866 the RTO [Russian Technical Society] was formed in St. Petersburg; it included many petroleum specialists.

In the initial period of its development, the USSR's petroleum industry had an acute shortage of specialists. It was necessary to provide qualified cadres and enlist specialists from other spheres of industry, to organize extensive training of petroleum specialists.

At the initiative of I. M. Gubkin and with the active support of V. I. Lenin, the Moscow Mining Academy was organized in 1918; later on, petroleum institutes were established in Baku and Groznyy. Later, cadres for the petroleum and gas industry were trained in Ufa, Kuybyshev, Kazan', Perm', Ivano-Frankovsk, Tashkent, Ashkhabad, Alma-Ata, Ukhta, and elsewhere.

In the 1930's, the first major detachments of new Soviet petroleum specialists appeared; under the guidance of Academician I. M. Gubkin they constituted the nucleus of VNITON [All-Union Scientific Engineering-Technical Society of Petroleum Workers].

The society's first congress was held 15 to 20 August 1933 in the oldest petroleum center--Baku. It was opened and conducted by I. M. Gubkin. (Since that time, tradition has dictated that congresses be held in that city). Some 202 delegates took part in the congress.

A characteristic feature of the first congress was the fact that it discussed not only scientific-technical tasks facing petroleum workers in connection with the expanding industrialization of the country but also broadly discussed problems of correct technical policies. The congress approved an elaborated program of field development that was optimal for that time.

VNITON organizations from the very beginning provided comprehensive help to engineering-technical workers in the in-depth study of the petroleum business, in upgrading their specialized knowledge, in training the most capable people for scientific-research work. This was especially vital for specialists coming from other sectors of industry.

Of great importance was the society's activities oriented toward correct mineral development, toward rapid introduction of the most perfected technological processes and new, advanced equipment, the organization of advanced methods exchange, the study and adoption of foreign experience.

For the Second Five-Year Plan, the party and the government set forth the task of the campaign "For Big Petroleum." The main petroleum producing regions at that time were the Trans-Caucasus, the North Caucasus, Azovo-Chernomorskiy Kray, Central Asia, the Ural-Emba region, Sakhalin Island, and the Volga-Ural region, where geological exploration work was underway. On 16 April 1939, the "Second Baku" was discovered. The Ishimbayevskoye petroleum field was discovered by A. A. Blokhin, a member of VNITON and a graduate of Moscow Mining Academy--a student of I. M. Gubkin. The Great Patriotic War hindered the full implementation of the formulated program. Despite the war, however, the society's organizations collaborated with all petroleum workers and stepped up the pace of their efforts.

The society helped the GSM [fuel and lubricants] service by conducting on-site and correspondence consultations on the selection, transport, and storage of motor fuel and oil, efforts to prevent losses, and so on.

In 1943, VNITON's organization bureau set up a committee consisting of VNITON members to standardize and study the physical-chemical properties of individual hydrocarbons.

In 1943, VNITON organizations took part in nationwide socialist competition among scientific-technical societies.

AzNITON [Azerbaydzhan Scientific Engineering-Technical Society of Petroleum Workers] won the VNITON challenge Red Banner in that competition.

A new stage in the development of USSR NTO's [scientific-technical societies] came in 1954, when they were transfered to the jurisdiction of the AUCCTU and became mass organizations thanks to broader possibilities for production leaders and innovators to enter their ranks. In connection with the upsurge in the gas industry, in 1958 the petroleum workers' society, by decision of the AUCCTU, was renamed the NTO NGP [Scientific-Technical Society of the Petroleum and Gas Industry].

Between 1959 and 1968, the NTO NGP held five congresses. Between congresses, plenums of the Central and Local Boards of the NTO NGP were convoked; they discussed problems of technical policies in various directions of development of the petroleum and gas industry in the light of the decisions of regular CPSU congresses and the country's trade union congresses.

In connection with the expansion of efforts to develop new petroleum and gas regions as rapidly as possible in Western Siberia and Western Kazakhstan, the Central Board of the NTO NGP in June 1964 held a conference on prospects for development in those regions. Conference participants called on all petroleum and gas industry workers to expand all-union socialist competition for accelerated geological work, field infrastructure development, development of the necessary equipment for a new, powerful upsurge in the petroleum and refining industry.

At the Sixth Congress, held in November 1972, the society was given the name of Academician I. M. Gubkin. By that time, NTO NGP incorporated 56 republic, kray, and oblast boards, 1,796 primary organizations, and 150,654 members.

Among the most important tasks facing all NTO NGP organizations and members, the congress defined the following: all-round active participation in implementing the decisions of the 24th CPSU Congress with respect to petroleum, gas, refining, and petrochemical industry development, also the formulation and discussion of predicted developments in the sectors; strengthening of society influence on the extensive and rapid adoption of scientific and technical achievements, inventions, and discoveries in production; strengthened contact between science and production. The congress introduced changes into the society's charter, which had been approved by the Second NTO NGP Congress in January 1962.

Efforts of the NTO NGP in the period since the Sixth Congress (1973--1977) have been directed toward developing the creative initiative and active participation of the scientific-engineering-technical intelligentsia and production leaders and innovators, enlisting them in the struggle to implement the master program worked out by the 24th and 25th CPSU congresses with respect to scientific-technical progress in the petroleum, gas, petroleum refining, and petrochemical industry.

The society's organizations and members are taking active part in the formulation and implementation of annual and long-term state production plans, also plans for the adoption of new equipment and technological processes, scientific-research processes, and scientific-research and planning-design projects in these sectors. The main realization of proposals made by the NTO to these plans is to be seen in the decisions and recommendations worked out on the all-union measures conducted by central and local boards of the NTO NGP in collaboration with the ministries, USSR Gosplan, the Central boards of the NTO's of related sectors, head sector scientific-research institutes, the MINKhiGP [Moscow Institute of the Petrochemical and Gas Industry imeni Academician I. M. Gubkin], and others.

Most of the proposals of the Central Board of the NTO NGP to the state plans for 1974-1976 and the main directions for the development of the petroleum, gas, petroleum refining and petrochemical industry for 1976-1980 were taken account of by USSR Gosplan, and with regard to inter-sector problems directed to VSNTO [All-Union Council of Scientific-Technical Societies].

Taking account of the exceptionally vital importance of upgrading the economic effectiveness of social production, at the initiative of our society, in collaboration with the Ministry of Petroleum Industry, Ministry of Gas Industry, and Ministry of Petroleum Refining and Petrochemical Industry, all-union conferences were held in 1972-1976 on improving economic effectiveness in the petroleum, gas, petroleum refining, and petrochemical industry. The decisions of these conferences served as guidance in the practical efforts of the primary organizations of the NTO NGP in the NGDU's [Petroleum and Gas Production Administrations], in petroleum and gas refineries, and other enterprises and organizations of these sectors. At the same time, the economics section of the Central Board of the NTO NGP, enlisting the help of highly qualified economists, drafted, and the Central Board published, a cycle of lectures dealing with problems of economics in the petroleum, gas, and petroleum refining industry.

The Fifth Plenum of the Central Board of the NTO NGP was held in 1974 in Kiev; it dealt with the problem "Improving the Quality, Reliability, and Service Life of Machinery and Equipment in the Petroleum-Gas, Petroleum Refining, and Petrochemical Industry and the Tasks of NTO NGP Organizations." In accordance with its decree, an all-union scientific-technical conference was held in Baku in 1975, with the participation of representatives from related sectors; the conference drafted a broad program of activities for scientific-research institutes, design organizations, and production enterprises in related sectors for petroleum workers.

Of great importance for improving the success rate and economic effectiveness of petroleum and gas geological-exploration work was the formulation of recommendations and decisions of the all-union conference dealing with this problem, held by the geology section of the Central Board of the NTO NGP jointly with the Central Board of the Mining NTO, the USSR Ministry of Geology, USSR Gosplan, the USSR Academy of Sciences, the RSFSR Ministry of Geology, the Ukrainian Ministry of Geology, 25 scientific-research institutes and planning institutes, and VUZ's training specialists in petroleum.

In the past five years, members of the presidium of the central and local boards of the NTO NGP have paid more attention toward exercising control over the process of implementing recommendations, proposals, and decrees of the scientific-technical society, discussing these problems at meetings.

In 1975 the presidium of the Central Board of the NTO NGP organized a check into the course of implementation of the decree of the Sixth NTO NGP Congress in the light of implementation of the Directives of the 24th CPSU Congress, and submitted this question for discussion at the Sixth Plenum of the Central

Board of the NTO NGP (June 1975). As a result, shortcomings were found in the work of some NTO NGP organizations; practical aid was given to them locally, and ways were mapped out for further efforts by central and local boards to implement the decree of the Sixth Congress.

Considering the importance of further expanding all-union socialist competition among workers in industry and transport for ahead-of-schedule fulfillment of national economy plans in the Ninth Five-Year Plan, the Central Board of the NTO NGP at a special plenum discussed the problem of participation by NTO NGP organizations and members in socialist competition through the formulation and implementation of personal and collective plans and obligations with respect to technical improvement in production. This form of NTO participation in socialist competition has become widespread over the past five years. Throughout the society as a whole, 81 percent of the members have personal plans. Every year, the VSNTO and Central Board of the NTO NGP total up the results of creative obligation fulfillment and award moral and material incentive to winners in competition for successful and ahead-of-schedule fulfillment of state plans. This is promoting the achievement of high technical-economic indicators in the activities of enterprises and organizations.

Much attention was focused on mobilizing the creative efforts of the scientific and engineering-technical community and innovative worker members of NTO NGP for a worthy greeting to the 25th CPSU Congress. Completion of increased obligations on the part of NTO NGP organizations and individual members in honor of the 25th CPSU Congress made it possible to provide production with more than 100 million rubles of provisional savings.

The success achieved by the NTO NGP made it possible for the first time for the society to notify the 25th CPSU Congress of its participation in handling the targets of the 24th CPSU Congress with respect to technical progress in the sectors. Especially active part was taken in pre-congress competition by the NTOs of enterprises and organizations in Orenburg, Leningrad, Moscow, Tataria, Bashkiria, the Ukraine, Latvia, the Komi ASSR, Turkmenia, Azerbaydzhan, Sakhalin, Uzbekistan, and Kazakhstan.

The Seventh Plenum of the Central Board of the NTO NGP, held in May 1976, discussed the tasks of NTO NGP organizations deriving from the decisions of the 25th CPSU Congress with respect to development of sectors of industry for 1976-1980, and passed a decree which set forth the ways and measures to be taken to help and participate in completing the targets of the Tenth Five-Year Plan.

Under the guidance of party and trade union bodies, 220,000 fans of scientific-technical progress in the petroleum and gas industry are taking creative part in resolving the problems set forth by the 25th CPSU Congress with regard to intensifying social production and further improving its effectiveness and the utilization of natural resources, stepping up scientific-technical progress in the sectors, boosting labor productivity and improving product quality, studying and disseminating advanced experience, perfecting the organization of labor, production, and administration.

Possibilities for fruitful work along these lines are opening up more broadly as a result of the development and strengthening of ties between science and production, and the formation of integral-process creative crews in the handling of complex urgent problems, utilizing the new form of labor that has developed in recent years in the NTO NGP under the slogan "Idea--Production." A vital role is played by creative cooperation agreements.

For example, working in close contact on the basis of cooperation agreements with NGDU Irkenneft' [Irken Petroleum and Gas Production Administration], Al'met'yevneft' [Al'met'yevsk Petroleum Administration], primary organizations of VNIIST [All-Union Scientific-Research Institute for the Construction of Long Distance Pipelines], VNIIOENG [All-Union Scientific-Research Institute for the Organization, Administration, and Economics of the Petroleum and Gas Industry], and the Scientific-Research Institute for Direct Current, the NTO of TatNIPIneft' [Tatar Scientific Research and Planning Institute for Petroleum] worked out a method for controlling corrosion in casing strings, using cathode protection, which was adopted by the inter-departmental commission and recommended for use in the petroleum sector during the Tenth Five-Year Plan. Also worked out on the basis of creative cooperative agreements and submitted to Glavtyumenneftegaz [Main Tyumen' Petroleum and Gas Administration] and Orenburgneft' [Orenburg Petroleum Industry Association] are alternative combined process-flow diagrams for petroleum preparation that are being used in various petroleum producing regions of the country. A new technology has been widely adopted for desalting Tyumen' petroleum without the use of fresh water.

The considerable creative efforts of scientists and engineers in TatNIPIneft' have helped to achieve high economic results in scientific activities. Thus, annual outlays on scientific-research projects in 1976 came to 3.7 million rubles, while the economic effect gained from the adoption of measures that have been worked came to 62 million rubles that year.

In the gas industry's achievement of labor triumphs in ahead-of-schedule fulfillment of the state plan and the plan on the adoption of new equipment during the first year of the Tenth Five-Year Plan, a worthy contribution was made by the NTO of the Orenburg board of the NTO NGP. The formation of creative integral crews and groups made up of members of VNIIGaz [All Union Scientific-Research Institute of Natural Gas], YuzhNIIGiprogaz [Southern Scientific Research Institute and State Institute for the Planning of Gas Industry Enterprises], VNIIPromgaz [All-Union Scientific-Research Institute of Gas Utilization in the National Economy and of Underground Storage of Petroleum, Petroleum Products, and Liquified Gas], VNIPIGazdobycha [All Union Scientific Research and Planning Institute of Gas Production], and the TsKB [Central Design Bureau] of scientific and engineering-technical workers of production subunits of Orenburggazdobycha [Orenburg Gas Production], the gas refinery, Orenburgtransgaz [Orenburg Gas Transport Association], and scientists of MINKhiGP imeni Academician I. M. Gubkin helped to resolve many urgent problems in the construction, operational startup, and mastery of the Orenburg gas complex. As a result of important measures undertaken

to perfect technological processes and improve product quality, the economic effect in 1976 throughout the Orenburg board of the NTO NGP amounted to 15 million rubles.

Considerable work is being done by NTO NGP organizations in the Ukraine (30,000 persons) with regard to developming the creative involvement of primary organizations and individual society members and getting them to participate in socialist competition for successful completion of the plans of the Tenth Five-Year Plan. In 1976, on the basis of personal and collective creative plans, enterprises and organizations in the Ukraine adopted 20,419 measures yielding an economic effect of 41,435,000 rubles.

Overall, NTO NGP organizations, on the basis of creative obligations adopted for 1976, worked out 134,000 recommendations and proposals, of which 108,000 were adopted in production. This made it possible for industrial enterprises of the sector to achieve a savings of 80.8 million rubles.

Frequently, the work experience of NTO NGP organizations has been presented to the VSNTO. For example, the working experience of the social council of scientific organization of labor of the primary NTO NGP organization of the Otradnyy UBR [administration of drilling operations] of Kuybyshevneft' [Kuybyshev Petroleum Association] was presented to the presidium of the VSNTO and recommended for dissemination. Izdatel'stvo Nedra published a pamphlet on this question. In 1975, the plenum of the VSNTO examined the work experience of NTO NGP organizations with regard to creative participation in accelerating scientific-technical progress. In 1976, the Bureau of the Presidium of the VSNTO listened to and approved the work experience of the Bashkir board of the NTO NGP on managing the work of the primary organizations, and presented an award to the board's active membership.

In May 1977, the Tenth Plenum of the Central Board of the NTO NGP discussed the tasks of the society's organizations in the light of the decisions of the 16th USSR Trade Union Congress.

One of the main tasks facing the NTO NGP is that of mobilizing creative efforts for a worthy greeting to the 60th anniversary of Great October. In honor of the glorious jubilee, NTO NGP organizations have adopted higher obligations.

The many-sided scientific-technical and organizational work of the NTO NGP, directed toward the development and improvement of socialist competition for completion of the plans of development of the national economy, has activated the efforts of the primary organizations and enlisted new creative forces in the ranks of the Society imeni Academician I. M. Gubkin. Thus, whereas from the moment of its founding in 1933 to 1972 the society numbered 146,000 members, in 1972-1977 alone the ranks of the NTO NGP were joined by 75,000 engineering-technical personnel, scientists, and production leaders and innovators. The authority of the primary organizations has grown; more than 50 percent of the NTO NGP primary organization councils perform the functions of enterprise production-technical councils.

Social creative associations have grown stronger organizationally and their activities have become more active: sections, Social Bureaus of Economic Analysis, Social Soviets of Scientific Organization of Labor, OBTI [Social Bureaus of Technical Information], and creative crews. In 1977, more than 45,000 society members are taking part in these crews. The amount of work done by them has increased, and the economic effect from their adoption has grown.

As a result of measures carried out by the VSNTO and the central and local boards of the NTO NGP for young specialists and students (displays, contests, seminars, conferences, and so on), there has been a marked rise in the commitment of young people and an increase in the influx of young society members. In 1976 alone, about 4,000 persons joined the society, and the ranks of the NTO NGP number more than 42,000 young specialists. There has been a marked strengthening in the financial base of NTO NGP organizations. For four years, the society has been completing financial and thematic plans successfully, and their indicators are higher than in the other societies. There has been a marked increase in the involvement of NTO NGP organizations, and their activities have improved with respect to enlisting the broad masses to participate in production administration.

Like the whole country, the NTO, with its everyday diligence and meticulous and multi-faceted efforts, is preparing a worthy greeting for the 60th anniversary of Great October.

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REGIONS, NEW DEVELOPMENTS IN PETROLEUM, GAS EXPLORATION

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[Article by N. S. Yerofeyev (Ministry of Petroleum Industry): "Main Stages in Geological-Exploration Work in the USSR"]

[Text] Explorers of mineral riches are greeting the 60th anniversary of the Great October Socialist Revolution with major successes and achievements in the cause of creating the raw materials base for the petroleum producing sector.

During the years of Soviet rule, on a vast territory of the Soviet Union embracing regions of the Volga-Ural, Siberia, the Far East, the Caucasus, Kazakhstan, Central Asia, the Ukraine, adn Belorussia, a large number of petroleum fields have been discovered; the exploitation of these fields has advanced our country into the world lead in the annual production of petroleum.

In pre-revolutionary Russia, most petroleum was produced in Azerbaydzhan and the Groznyy region; small amounts were produced in Emba, Cheleken, Maykop, and Fergana.

From the very first days of Soviet rule, the party and the government focused special attention on petroleum industry development. As a result, in a very short time, the country's petroleum production was not only restored but also surpassed the maximum level achieved before the revolution. This was facilitated by a considerable expansion of petroleum-prospecting projects which were systematically carried out in many promising regions and led to the discovery of new deposits.

New petroleum fields were discovered in Azerbaydzhan, the Chechen-Ingush ASSR, Dagestan, Krasnodarskiy Kray, and Western Turkmenia. It was these regions which held a leading position for a long time (practically up until the Great Patriotic War) in the country's balance of explored reserves and production.

Of especially great importance was the finding of industrial flows of petroleum in the region of Chusovskiye Gorodki in 1929, in the Permian deposits. This launched the beginning of the discovery and development of the vast petroleum and gas province between the Volga and the Ural, which later came to be known as the "Second Baku" and came to be of vital national importance.

Since the 1930's, systematic prospecting work has been carried out in the Ural-Volga region, the Komi ASSR, on Sakhalin, Tadzhikistan, and other regions. This work has made it possible to make new fundamental discoveries which have radically change the geographical placement of the petroleum producing sector and the country's energy balance.

During the Great Patriotic War, the discovery and development of fields in the Ural-Volga region provided great help to the front lines by providing them with petroleum products.

In 1929-1944, 21 petroleum and gas fields were discovered in the Volga-Ural province, in the paleozoic deposits of Bashkiria, Tataria, and Kuybyshevskaya, Perm'skaya, and Saratovskaya Oblasts. Of great importance was the discovery of Devonian petroleum.

The post-war period was characterized by the extensive development of prospecting and exploratory work for petroleum in the Volga-Ural region. The intensive discovery of highly-productive petroleum fields continued underway in that region for more than two decades. In Tataria, the Romashkinskoye, Novo-Yelkhovskoye, Bavlinskoye, Pervomayskoye, and Bondyuzhskoye fields; in Bashkiria, the Tuymazinskoye, Shkapovskoye, and Arlanskoye; in Udmurtia, the Vyatskoye and Mishkinskoye; in Kuybyshevskaya Oblast, the Mukhanovskoye, Pokrovskoye, and Mikhaylovsko-Kokhanskoye; in Orenburgskaya Oblast, the Sultangulovskoye, Zaglyadinskoye, and Pokrovskoye; in Perm'skaya Oblast, the Yarino-Kamennolozhskoye, Batyrbayskoye, Osinskoye, and Pavlovskoye; in Saratovskaya Oblast, the Sokolovogorskoye, Stepnovskoye, and Uritskoye; in Volgogradskaya Oblast, the Korobkovskoye, Zhirnovskoye, and Bakhmet'yevskoye; and many others.

In economic terms, prospecting and exploration for petroleum in the carbon and Devonian deposits of the Volga-Ural province were distinguished by high effectiveness. The exploitation of these deposits with the use of advanced systems of development, equipment, and technologies, made it possible to make substantial changes in the economy of the USSR's petroleum industry and to create conditions for providing the necessary correlations in the structure of the country's industrial production.

The Volga-Ural province is also of great importance to petroleum production at the present time. Further prospects for discovering petroleum deposits within the province must be linked to the Kama-Kinel' trough system, especially the Dzhebel'-Visher and Kizelovskiy troughs in Perm'skaya Oblast and the Mukhanovo-Yerokhovskiy trough in Orenburgskaya Oblast, the Mozhchinskiy

and Fokinskiy troughs within the Upper Kama depression, the territory between the Vereshchaginskiy swell and the Chutyrsko-Nozhovskaya group of fields, the southern portion of the Buzuluk depression, the East Orenburg ridge and the Pre-Ural trough, and also the lead folds of the Ural.

Important results came from petroleum exploratory work in the Ukraine, where the Western-Ukraine, Dneprovsko-Donetskaya, and Prichernomorsko-Krymskaya petroleum and gas bearing regions were found. Of special importance was the discovery of the Dneprovsko-Donetskaya region, where geological-prospecting work got underway on a large scale after the discovery of the Shebelinskoye and Radchenkovskoye fields in 1970. As a result, new petroleum and gas fields were discovered in permian and carbon deposits (Kachanovskoye, Glinsko-Rozbyshevskoye, Gnedintsevskoye, Prilukskoye, and others). In recent years there, confirmation has been made of the regional petroleum and gas bearing potential of the lower carbon complex within the limits of the northern (fields of the Talalayskaya group, the Artukhovskoye, Anastasiyevskoye, Gadyachskoye, and others) and the southern edges (the Reshetnyakovsko-Rudenkovskaya uplift zone, the Glinsko-Rozbyshevskaya, and others) of the depression. The Lower Visean-Tournaisian complex was delineated as a separate object of exploration, and prospects of the Devonian deposits were pinpointed. Within this petroleum and gas bearing region, the main thrust of prospecting-exploratory work involves the industrial evaluation of the prospects of the petroleum and gas potential of the Devonian and the prospecting of petroleum and gas in the lower carboniferous deposits on the uplifts of the central and northern margin zones.

In 1964, an industrial petroleum potential was determined in Belorussia, in the Rechitskaya, Tishkovskaya, Davydovskaya, and Ostashkovichskaya areas; this made it possible to develop a new petroleum industry center in the country's western portion. In recent years in Belorussia, an industrial petroleum potential has been determined for new tectonic zones--the Malodushinskaya and Vostochno-Pervomayskaya zones; also demonstrated is the productivity of the depressed side of the Rechitsko-Vishanskiy swell. This enlarges prospects for exploring new fields in Belorussia.

The country's "older" petroleum regions also developed at a fast pace--the North Caucasus and Azerbaydzhan, where new fields were also found in Dagistan, the Chechen-Ingush ASSR, and Krasnodarskiy and Stavropol'skiy Krays. In addition, as a result of successful exploratory work off-shore in the Caspian Sea, petroleum fields were discovered at Neftyanyye Kamni, Peschanyy Island, Sangachaly-more, Duvannyy-Ostrov Bulla, Bulla-More, Bakhar, Gyurgany-More, and others. Work in recent years has demonstrated the industrial productivity not only of the Azerbaydzhan sector of the Caspian but also the Dagistan sector (Inchkhe-more), Kazakh (Rakushechnoye), and Turkmen (Zhdanov bank, Lam bank, and others), evidencing significant prospects for the discovery of new fields there. At present, off-shore petroleum fields are providing most of the production in Azerbaydzhan.

In the North Caucasus, objects of prospecting and exploration work in the future should be the lower structural stages within the platform regions and deep-lying mesozoic deposits in the forward troughs. In Azerbaydzhan, the main prospecting objects should continue to be the lower portion of the productive bed of the Nizhnekurinskaya and Muchanskaya lowland, and the mesozoic deposits of the Kyurdamirskaya and Shemakhino-Kabystanskaya regions. On the shelf of the Caspian Sea, major increases in reserves can be found in the Azerbaydzhan and Turkmen portions, where new uplifts have been delineated and prepared for drilling.

Major discoveries include the striking of large petroleum gushers in Georgia, where geological-exploration work did not yield significant results for many years. In 1974, a high-yield petroleum deposits was discovered there in the eocene deposits near Tbilisi in the Samgori area, and a new petroleum deposit at the Supsa field. In 1975, in the Teleti area, located in the vicinity of the Samgori-Patardzeul'skoye field at shallow depths (600 to 650 meters), a determination was made of the petroleum potential of the upper portion of the middle eocene. These discoveries have confirmed the prospects for the petroleum potential of several regions in Georgia; this has made it possible to expand the amount of prospecting-exploratory work necessary to step up the pace of preparation of petroleum reserves in the Tbilisi, Gare-Kakhetinskiy, Chomgorskiy, and Guriyskiy regions in Miocene, eocene, and upper cretaceous deposits.

Major geological discoveries have been made in Kazakhstan and Central Asia; this has placed them among the leading petroleum regions of the USSR. The discovery of the multi-stratum Zhetybay and Uzen' fields in 1960-1961 on Southern Mangyshlak and Western Kazakhstan launched the beginning of the development of a new petroleum and gas region there. In recent years, the petroleum potential has been determined for Buzachi Island, where the Karazhanbasskoye, Severo-Buzachinskoye, and Kalamkaskoye petroleum fields were discovered. Also demonstrated is the regional industrial petroleum and gas potential of the subsalt deposits of the Kazakh sector of the Caspian depression on the Kenkiyak and Karatyube areas. The results of geological-exploration work there make it possible to delineate several zones of petroleum and gas accumulation, the formation of which is controlled by ridges of the subsalt bed, which represent high-priority objects for deep-well drilling. In the Southern Mangyshlak petroleum and gas bearing region, major prospects must be linked to the Pre-Jurassic (Triassic) complex.

Until 1956, deposits found in Central Asia were located in Western Turkmenia, the Fergana depression, and Uzbekistan's Surgan-Dar'inskaya Oblast. The vast expanses of the Kara-Kum and the Kyzyl-Kum deserts remained practically unstudied. Systematic geological study of these regions begun in 1957 proved to be highly effective and led to the discovery of petroleum and gas fields. The Kotur-Tepe, Barsa-Gel'mes, Gogran'dag, and other petroleum fields were found in Western Turkmenia.

The discovery of the Niyazbekskoye and Karagachinskoye petroleum fields in paleogenic deposits in recent years in the southwestern portion of Fergana is of great importance for evaluating the prospects of the petroleum and gas potential of this region, because not enough attention has been paid to the study of the paleogenic and masozoic deposits there.

In Central Asia, we can expect major increases in petroleum and gas reserves from the discovery of petroleum fields in the red-bed deposits of the Pribalkhanskiy Rayon and Gogran'dag-Okaremskaya uplift zone of Turkmenia, the Pliocene complexes of the Kyzyl-Kumskiy trough, and the mesozoic deposits of the Western Turkmen depression. In the platform portion of Central Asia, petroleum deposits can be found within the Chardzhouskaya stage and the Bakhardokskiy slope. In the Fergana depression, major prospects are linked to paleogenic deposits of the Marchilanskaya and Supetauskaya stage, also the central Graben; also promising are the mesozoic deposits of the southern Tadzhik depression.

Since 1959, the Timan-Pechora region has been undergoing acclerated development. Thanks to the fact that the entire territory has been thoroughly covered with geological studies, reference, parametric, and prospecting drilling served to discover the Zapadno-Tebukskoye, Dzh'yerskoye, Pashninskoye, Usinskoye, and Vozeyskoye fields, and others, the production startup of which sharply increased petroleum production. Recent years have seen the discovery of the Yareyyusskoye, Verkhne-Grubeshorskoye, Yuzhno-Shapkinskoye, Layavozhskoye, and other petroleum fields, which testify to the petroleum and gas potential of the entire northern part of the Soviet Union's European territories. A center for petroleum production development has been set up on the basis of the discovered fields, and every precondition exists for boosting reserves.

On Sakhalin, the petroleum industry began to develop most intensively after 1959, when volumes of prospecting-exploratory work were increased. This led to the discovery of the Kolendo, Shkhunnoye, Volchinskoye, and other fields. Recent years have seen the discovery of the high-yield Vostochnoye Dagi, Mongi, and Nabil' fields; this has widened the prospects of the Katanglinsko-Nabil'skiy region. Further prospecting efforts must be focused primarily on the eastern part of the island.

Special mention should be made of the development, under difficult geological-climatic conditions, of the industrial petroleum and gas potential of the new Western Siberian province, which has had a profound impact on the development and placement of the country's petroleum industry. Intensive study of this province began in 1953 after the discovery of the Berezovskoye gas field. Now, many petroleum and gas fields have been discovered there; they are controlled by anticlinal uplifts. The main pools are coextensive with the Neocomian deposits in the middle Ob' petroleum and gas region, where the Samotlorskoye, Fedorovskoye, Var'-Yeganskoye, Kholmogorskoye, and other fields were discovered.

Western Siberia has developed a major petroleum production center, and the further development of the sector as mapped out in the decisions of the 25th CPSU Congress is linked to the exploitation of deposits in this region. Exploratory work will continue in the middle Ob' region, also the Gdynskaya, Nadym-Purskaya, and Purtazovskaya petroleum and gas regions. The most important task is that of reliably evaluating the industrial petroleum potential of the northern part of Western Siberia.

The recent period of development of geological-exploration work, encompassing the years of the Eighth and Ninth five-year plans, in many petroleum and gas regions is characterized by increasingly difficult conditions affecting the prospecting and exploration of petroleum fields linked to:

the fact that most of the Ural-Volga, Caucasus, Central Asia, and Ukraine have already been completely explored, and hence the low probability that major fields will be discovered;

the fact that exploration now goes into new regions that are more difficult in terms of geology and natural-climatic conditions, regions that are undeveloped or practically undeveloped;

the exploration of objects in the lower structural stages lying at considerable depths and characterized by great difficulty in drilling;

ever-increasing volumes of prospecting in deposits which are controlled by regional wedging-out and stratographic unconformity zones.

During these years, however, especially the Ninth Five-Year Plan, scientific methods of forecasting came to play a larger role in the selection of promising directions and objects for prospecting new petroleum fields. This accelerated the discovery of petroleum reserves in new regions and stepped up the intensity of determining reserves in regions of a high level of development.

On the whole, success in discovering the country's petroleum resources have depended on carrying out large amounts of regional and detailed geological-geophysical work, including various modifications of field geophysical studies as well as the drilling of reference, parametric, structural, prospecting, and exploratory wells. Special attention has been focused on mapping out a rational complex of prospecting-exploratory work with respect to the specific geological conditions of individual regions, also problems relative to the effective deployment of efforts oriented toward discovering primarily major petroleum and gas regions, areas, and zones of petroleum and gas accumulation, taking account of their geographical-economic distribution within the country.

These successes have also resulted from constant efforts to improve equipment and technology involved in the prospecting process, calling for the use of advanced drilling equipment making it possible to drill down to

depths of 5,000 meters or more, the widespread adoption of cluster and controlled directional drilling and so on. Substantial changes have taken place in the techniques and technologies of methods of exploratory geophysics and, especially, the widespread use of the total depth point method in seismic exploration, processing all data on computers. The adoption of this methodology has made it possible to study the deep geological structure of many petroleum and gas regions and to delineate new promising objects of prospecting efforts. In addition, extensive use has been made of geochemical methods of exploration (well gasometry, radiometry) in order to evaluate the potential of prospecting and exploratory areas; the latest air-geological methods have been adopted, involving material from space surveys. Higher effectiveness in geological-exploration work has also been facilitated by the adoption of new methods of field-geophysical well study: induction, acoustic, and microlateral logging, also the extensive use of stratum testers in the drilling process.

Integrated prospecting-exploratory projects in promising regions are being adopted more and more; they make it possible to make rational use of amounts of exploratory drilling. Scientific-research organizations are conducting thematic research in accordance with requests from production enterprises. Moreover, special attention is being focused on the study of the laws governing the formation and distribution of petroleum and gas fields.

The tasks of geological exploration work in the Tenth Five-Year Plan involve accelerating the delineation of new fields in Tyumenskaya Oblast, Eastern Siberia, the Yakut and Komi ASSR's, Arkhangel'skaya Oblast, Central Asia, and Kazakhstan (the Caspian depression). Plans call for preparing additional reserves in regions of producing fields in the European territories.

The expansion of efforts in Eastern Siberia, the northern European territories, and the northern part of Western Siberia will require faster development of new technical means--light-weight and highly-mobile drilling rigs.

Successful expansion of efforts in the older regions, where most of the easily-accessible reserves of petroleum have already been detected and explored, imposes no less complex and even more variegated requirements on scientific-technical progress in the field of geological-exploration work. These requirements involve prospecting deposits in deep-lying lower structural stages, where seismic exploration has not yet been effective enough to delineate them (especially in cases of logging rocks that are poorly differentiated in terms of elastic properties); they also involve the development of prospecting drilling into subsalt and, in the future, into subtrap complexes of sedimentary rock and the necessity of completing significant volumes of work involved in prospecting deposits of the "non anticlinal type.

The rapid decline in the effectiveness of prospecting-exploratory work in the older regions can and must be stopped, and the pace in the newer regions can and must be increasingly stepped up by: improving the quality of area

preparation for deep drilling, raising the degree of reliability of conclusions concerning stratum productivity on the basis of field geophysical data; more reliable and detailed forecasting of petroleum and gas potentials based on the study of the laws and patterns governing the formation and distribution of deposits, fields, and petroleum and gas accumulation zones; improved methods of prospecting and exploration, and rational deployment of volumes of geological-prospecting and exploratory work.

Inspired by the decisions of the 25th CPSU Congress and heading to greet the glorious 60th anniversary of Great October, our petroleum and gas explorers are fully resolved to carry out the assignments given to them.

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PROPOSALS ON IMPROVING PETROLEUM ADMINISTRATION

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 45-49

[Article by V. I. Grayfer (Ministry of Petroleum Industry) and M. M. Umanskiy (VNIIOENG): "Improving the Administration Mechanism in the Petroleum Industry"]

[Text] The past 60 years since the proclamation of Soviet rule in our country, and especially the post-war period, have witnessed profound changes in the economics of the petroleum industry, changes that have raised the sector to a qualitatively new, higher level.

The main sources of sector development are, increasingly, improved production effectiveness and improved quality indicators in petroleum and gas production and refining, well construction, and petroleum transport. Labor productivity--a decisive factor in the further development of production and improved effectiveness has risen by eight times in the last 30 years. In 1965 through 1976, increased labor productivity accounted for more than 90 percent of the increase in petroleum production. Labor productivity also rose substantially in well drilling, gas refining, and long-distance petroleum transport. In terms of absolute profits, which constitute a most important generalizing characterization of the effectiveness of social production, the petroleum industry holds one of the leading places among sectors of heavy industry. In the past ten years (1967-1976), large profits have been earned as a result of scientific-technical progress in the field of developing petroleum fields and drilling wells, and systematic improvements in the economic mechanism and methods of management in petroleum and gas production associations. These profits have paid back a substantial portion of all capital investments in the petroleum industry made during that period.

While commenting on the major contribution made by the petroleum industry toward improving the effectiveness of social production, we cannot fail to mention also the decline in such important economic indicators of sector development as the prime cost of petroleum production, return on capital, and profitability. Despite increased profits, their relative value--profitability--declined by 40 percent in 1976 compared with 1970. As a result,

several production associations (Azneft' [Azerbaydzhan Petroleum Association], Sakhalinneft' [Sakhalin Petroleum Association], Dagneft' [Dagestan Petroleum Association], Uzbekneft' [Uzbek Petroleum Association], Kirgizneft' [Kirgiz Petroleum Association], and Tadzhikneft' [Tadzhik Petroleum Association]) have a profitability level so low that they cannot even provide for normal economic activities.

The increased prime cost of petroleum production and the decline in other economic indicators are due primarily to the fact that the main petroleum fields of the Ural-Volga region, the North Caucasus, and the Trans-Caucasus have entered the late stage of exploitation, also the fact that less productive and smaller fields have been put into operation in the European territories, petroleum bases are being created in economically underdeveloped regions characterized by difficult natural-climatic conditions, and increasingly large proportion of the new production capacities are not being oriented toward an absolute increase in petroleum production but toward compensating for its decline in the older, depleted fields.

While commenting on the impact of unfavorable conditions of sector development on economic indicators, we cannot at the same time fail to see the unutilized reserves (better utilization of the inventory of petroleum and injection wells and other structures and equipment), also of human labor times, outlays of which, especially in auxiliary operations, are still intolerably high in many areas).

Despite the decline in individual economic indicators of the petroleum industry, its importance to the national economy has not declined. Petroleum has been and remains an indispensible, a most effective raw material for the production of motor fuels, oil, and products of organic synthesis. It is estimated that if the structure of the country's fuel balance in 1975 had remained at the 1960 level, it would have been necessary to boost fuel production by about 100 to 120 million tons of standard fuel, to invest an additional four to five billion rubles in the fuel producing sectors of industry, and overspend at least 2.5 billion rubles every year just on the production and transporting of fuel. Increasing petroleum production, therefore, is a vital factor in improving the effectiveness of social production.

At the same time, in the producing sectors of industry capital investments for the development of facilities for production perunit of product are more than three times greater than in the processing sectors. During the current five-year plan, for this reason, as was stipulated in the decisions of the 25th CPSU Congress, the groundwork is being laid for the further growth of the country's energy potential--primarily through the use of hydroelectric power, nuclear fuel, and low-cost coal. Increases in petroleum production will be increasingly channeled into technological needs. This will make it possible to achieve rational and economical utilization of petroleum reserves and will be consistent with the interests of improving the effectiveness of social production.

Improvements in the effectiveness of the sector's work have been facilitated by the use of the mechanism of the new system of planning and economic incentive. This primarily involves on orienting the plans of the sector and all its production links toward the end national-economic results--the fullest possible satisfaction of the country's need for petroleum and petroleum products, with the maximum possible utilization of intensive factors of growth; also, enhancement of the role of the five-year plan as the main form of planning in sector activities; optimal correlation of five-year and annual plans and, on this basis, through comprehensive evaluation of the developed production potential and scientific-technical progress, insuring of the most economical solutions to planning tasks; also, finally, the adoption of the program-oriented, integrated method of planning in the development of new petroleum regions, and so on.

As petroleum production has risen, as fields located in regions that are difficult to develop economically have been put into production, and as the number of other sector problems to be solved simultaneously has risen, it has become increasingly difficult for the plan to stipulate resources to accomplish them. It has become obvious that we no longer get by without integrated solutions to major planning problems. Integrated programs each of which stipulate a precisely delineated goal, the necessary resources for accomplishing it, stages and timetables of execution, and the makeup of coexecutor organizations and their affiliation, have been effectively utilized in resolving such problems as the technical retooling of the sector and the development of the new petroleum base in Western Siberia.

In recent years, with the enlistment of the petrochemical and chemical sectors, petroleum machine building, and other related sectors, an integrated program of projects has been worked out for increasing stratal yields over the long term future. The implementation of this program, equivalent to the discovery of a large petroleum field, will yield substantial economic benefits.

A key role in the shaping of the sector's economic mechanism is played by the restructuring of the organizational structure of the sector--the creation of production associations. Between 1968 and 1975, the petroleum industry completed the transition from the multi-stage system of administration to the two- or three-link system. The main or primary link, in contrast to the enterprise, which represented the main link the management system during the pre-war period, is now the production association--a unified production-economic complex which combines production units (NGDU's [Petroleum and Gas Production Administrations]), a number of production operations, and separate enterprises (UBR's [Administrations of Drilling Operations], construction enterprises and others), which handle the performance of all stages in the technological process of petroleum production.

Relieving main production enterprises of service functions, consolidating them within the framework of specialized subunits, concentrating material and financial resources within the framework of the association, and expanding the rights and responsibilities of the association--all of these are

helping to develop regions more effectively. The association now has the capability of taking fuller account of the latest technical achievements in the its plans, of redistributing resources in the needed directions in order to handle technical problems in individual segments of production, of making more effective use of advanced forms of wages and economic incentives, and resolving other tasks. As a result, the ministry's apparatus can focus its efforts primarily toward improving centralized planning management and concentrate their efforts on major long term problems.

In the course of perfecting the mechanism of sector administration, it became necessary to develop and strengthen cost accounting--the basis of the sector system of planning and economic incentive. Increased specialization, cooperation, and concentration of production within the association and conversion of enterprises into production units can be effective only if all internal cost accounting relations are thoroughly worked out among production subunits. Thus, the transfer of enterprises that were formerly independent to the status of production units, in which they are relieved of obligations to handle accounts with suppliers for material goods and even to the workers for the payment of wages, may reduce their material responsibility, motivation, and economic initiative. For this reason, along with converting the production association into the main or primary cost-accounting link of the sector, a system of cost-accounting indicators of planning, record-keeping, and evaluation of the performance of the association subunits has been worked out and adopted; this makes it possible to overcome these negative tendencies.

Under economic methods of administration, the desired goal is achieved by acting on the economic interests of the facility being administered. These methods are closely linked to the use of such economic levers as price, bonuses, wages, rent, deductions to pay for outlays on geological-exploration work, penalties, and so on.

In 1975, standard prices on petroleum and gas were introduced for every association; in 1976, standard rates on rent payments. This served to strengthen the financial base of the associations and, to a certain extent, the sector's financial base. Above-plan recovery of casing-head gas is exempt from deductions to pay for outlays on geological-exploration work, while for above-plan gas losses the rate of these deductions is raised by 1.5 times. A system of petroleum price surcharges and discounts has been introduced for petroleum preparation quality. Considerable efforts on improving the mechanism for the formation of incentive funds resulted in the formulation of a unified sector system. Deductions into the material incentive fund are now made through the application of per-ton rates, the use of which determines amounts of deductions into the fund of the whole sector collective, including workers engaged in petroleum production, drilling, and auxiliary services. Such a system is oriented toward the end results; it motivates the whole collective of the sector to achieve the common goal--that of increasing petroleum production.

In recent years, planning and economic incentive have been developing unilaterally. Consequently, only individual elements of the economic mechanism have undergone improvement. It is now necessary, therefore, as is noted in the documents of the 25th CPSU Congress, to strengthen the integrated impact exerted by the plan, economic levers and stimuli, and the whole system of administration on accelerating scientific-technical progress, improving product quality, upgrading the effectiveness of social production, and achieving end national-economic results. Essential preconditions for further improvement in the administration of sector effectiveness and raising it to a qualitatively higher level include an integrated approach to the resolution of all problems of the economic mechanism, refusal to allow individual components in the mechanism to act in the opposite direction, and efforts to combine their impact.

A most important factor in improving administration over the next few years continues to be improved planning. Efforts must be continued on perfecting the system of plans and methods of sector planning, based on the use of a broad range of forecasts which take full account of changes in petroleum requirements and resources and allow us to compare various alternatives in the development of the sector and individual regions, taking account of current and long term consequences.

The course of action aimed toward increasing the responsibility of all economic links for the completion of five-year plans gives rise to the urgent problem of insuring the reliability and stability of these plans. And this at a time when it is impossible to foresee with any accuracy the discovery of new fields or the development of new technical inventions, to evaluate in a quantitatively accurate manner the future values of already fundamentally known parameters and other indefinite and random factors.

Unfortunately, no serious investigation is as yet underway in the petroleum sector with regard to the problem of plan reliability given the probability-indefinite properties of the system. There is also no tested methodology for calculating methods of insuring reliability in planning.

The reliability of plans must be combined with their intensiveness. There now exist indicators for plan intensiveness evaluation that are common to all sectors. But these indicators alone cannot be used to evaluate the intensiveness of the plan of the petroleum industry and its associations. It is essential to make up for this lack as soon as possible.

An essential factor in further improving sector planning is the necessity of improving plan indicators and criteria for evaluating the work of enterprises and production links. It is essential to review many intermediate indicators and determine whether they best facilitate the achievement of end sector results, and on this basis set up conditions under which all sector subunits are interlinked on the basis of economic feasibility and unity of goal--that of comprehensively improving petroleum production operations and upgrading the effectiveness of production.

Special significance attaches to the administration of scientific-technical progress and, on this basis, prompt implementation of all scientific-technical advances and extensive practical utilization of them.

We have not yet managed to do away with disconnectedness and lack of coordination in the "science--technology--production" chain. This is diminishing the success rate of scientific research and technical applications and artificially prolonging the entire period between research and the dissemination of new technology. Moreover, the scientific-technical progress plan basically represents a list of individual measures which do not add up to an increase in output guaranteed by the development of science and technology, which cannot be used to determine the impact which measures implemented in accordance with the plan have on the indicators of production development which characterize its effectiveness.

Further improvement of the economic administration of scientific-technical progress requires a new approach to the planning of scientific and technological development:

1) conversion from substantiating the necessity of particular measures in the scientific and technical development plan to substantiation of a complex of technical applications which must be carried out by scientific and production organizations in order to achieve a pre-stipulated technical-economic level of production and lay an optimal scientific groundwork for the future;

2) implementation of integral process planning of new equipment, from scientific research and experimental projects through to adoption in production. The main purpose of integral process planning is to assure unity, continuity, ongoingness, and integration of the efforts of all participants in the research--technology--production cycle and, on this basis, shortening of the timetable for the development and adoption of new technology;

3) organic interlinking of the scientific and technical development plan with other aspects of the sector plan. It is on this basis that the resources necessary for the introduction of innovations and their impact on the results of production should be determined in the sector's plans with respect to the conditions of the planned period and with account taken of volumes of new technology adoption.

Along with this, it is essential to set up a precisely functioning economic mechanism which will insure stimulation of technical progress. It is well known, for example, that new methods of exploiting petroleum fields designed to increase stratal output--despite their high national-economy effectiveness--require higher outlays of the associations, especially during the period of field development, and are therefore economically disadvantageous. It is essential, therefore, to have an efficient and effective system of economic incentive to technical progress which can be utilized in the interests of this complex process, during which considerable difficulties must be overcome. The formation of a centralized cost-accounting fund for boosting

overcome. The formation of a centralized cost-accounting fund for boosting petroleum output in the petroleum industry is first step in this direction.

One of the most urgent tasks at the present stage of the sector's development is the application of the economic mechanism to stimulate the most rational utilization of petroleum resources. Economics has the last word in resolving such questions as the division of petroleum reserves into balance and trans balance; determining the maximum exploitation of petroleum fields, the sequence in which they are to be put into production, and the final coefficient of petroleum yield; substantiation of technological applications designed to increase stratal output, selection among alternatives of field exploitation; stimulation of fuller extraction from the ground; establishment of petroleum prices; and so on.

The wholesale price level on petroleum is inadequate to provide for normal functioning of the sector on a cost-accounting basis and to stimulate the rational consumption of this scarce resource. As a result, petroleum refineries which consume substantial quantities of fuel for their own needs often find it disadvantageous to undertake measures to save on fuel, although the national economy would benefit greatly from this. It is essential to boost petroleum prices substantially.

The prime cost of petroleum production reflects only a part of the outlays involved in petroleum exploration. It is necessary to increase the amount of these deductions in order to take them fully into account in the prime cost of production and also to apply them for purposes of rational utilization of petroleum resources. To resolve this problem we should release the associations from budget contributions of deductions for repaying outlays on geological-exploration work in the case of fields and facilities in which a stipulate petroleum yield coefficient has been achieved, and the exploitation of which, given present technologies, is technically impossible or economically unjustified.

The next few years must be a time of further development in cost-accounting. This involves not only strengthening the principles which govern its effect in the main or primary link--the production association--but also increasing the effectiveness of cost accounting in the lower-level production links, and also extension of cost-accounting relations to the top link in sector administration--the ministry. This means systematically converting not only current, one-time outlays to the cost-accounting basis but also, especially, outlays on scientific-research work. As the instrument of cost-accounting stimulation, extensive use should be made of wages, the proportion of which predominates in the general wage fund.

The organizational basis for further improvement of the mechanism of sector administration is to continue and develop work that was done during the Ninth Five-Year Plan to restructure the administrative structure. The sector's work experience under the new conditions has demonstrated that the measures undertaken are not complete. In some NGDU's, the regional engeering-technological services, which constitute the operational

administrative body, are in effect performing the functions of a production subunit. The process of concentrating the auxiliary operations of the NGDU within the framework of the BPO [base of production maintenance] is dragging on too long. Petroleum production operators are frequently repairing equipment, thus duplicating the work of the BPO. Work is going too slowly on centralizing the repair service within the framework of the association. Small-scale mechanical shops have been retained in individual sections of the NGDU's. Most of the capital repairs performed on drilling and petroleum field equipment are being done in the association's subunits. As a result, possibilities for improving production effectiveness as stipulated in the new administrative structure are not being fully utilized. It is essential to implement these possibilities.

The petroleum industry has reached a level of development in which the crucial factor of further growth involves steady improvement in production technology and a higher level of organization, improved methods of management and increased production effectiveness.

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TECHNICAL PROGRESS IN THE PETROLEUM PIPELINE SYSTEM

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 49-51

[Article by A. A. Kulikov (Ministry of Petroleum Industry) and M. N. Shpotakovskiy and I. P. Moskal'kov (Giprotruboprovod): "The Country's Petroleum Arteries"]

[Text] In 60 years of Soviet rule, petroleum pipeline transport has been transformed into a most effective section of the country's transport system. Over the past 10 years, the pipeline system has grown by more than two times; the amount of petroleum carried in the network, and its freight turnover, have increased by two and five times, respectively. These figures testify to the increased national-economy significance of pipeline petroleum transport, especially considering that the prime cost of pumping petroleum is two to three times lower than the cost of rail transport, and some of the main and potential regions of petroleum production do not have the traditional transport means available in other petroleum producing regions. Rising volumes of petroleum production and the necessity of transporting it over long distances make pipeline transport indispensible for development remote regions of Siberia.

The average distance petroleum was being pumped by 1977 was 1,400 km, and on some lines (for example, the Druzhba system) more than 3,000 km.

All of the petroleum refining regions of the Soviet Union are linked by pipeline to petroleum producing regions. But despite the fact that pipeline transport firmly occupy a leading place in the country's transport system, the role of the railroads in hauling petroleum products is still substantial. The actual amount of petroleum transported by pipeline with respect to the level of production stands at more than 95 percent.

During the Tenth Five-Year Plan, plans call for a further rise in indicators with respect to this type of transport as a result of the construction of about 15,000 km of new long distance pipelines. This large program of construction, closely linked to the needs of accelerating the development of petroleum production, is being implemented simultaneously with the constant growth of the technical level of the pipeline systems.

Technical progress in long distance pipeline transport over the past decade has primarily involved increasing the diameter of the pipes, which has demonstrated definite economic advantages. If as the basis of comparison we take a petroleum pipeline of 530 mm diamater and assume required capital investments, outlays on pipe and equipment material, and pumping prime cost to be 100 percent, then by increasing the diameter to 1,220 mm we reduce these outlays to 31.1, 33.9, and 47.7 percent, respectively. The use of large-diameter petroleum pipelines is especially effective on segments of pipe routes which include smaller-diameter pipes.

By 1976, the entire network of long distance petroleum pipelines in the Soviet Union was characterized by the following figures on diameters as a percentage of the total length.

Standard Diameter, mm	Length, percent
500	22
600	1
700	24
800	13
1,000	14
1,200	11

Pipelines of smaller diameters amounted to about 15 percent of the total.

Pipeline transport is developing on the basis of a state plan drawn up to take account of the location of petroleum producing facilities and actual prospects of petroleum production development. This is being facilitated, in particular, by systematically working through and perfecting master plans of its development.

For pumping petroleum through large-diameter pipelines, special centrifugal pumps have been developed and adopted, with productivities of 1,250 to 12,500 cubic meters per hours and efficiencies between 68 and 89 percent. They are driven by highly-efficient small-size electric engines of the synchronous type of 1,250 to 8,000 kilowatts capacity and 3,000 RPM.

The operating of pumping stations with such equipment is organized on the "from pump to pump" system; this makes it unnecessary to build costly tank yards at intermediate pumping stations, and their number can be reduced to the technological minimum along the pipelines. Along with reducing the amount of metal consumption, this kind of technology of pumping station operation reduces petroleum losses during transport.

Pumping stations and line facilities that have been built in the past 10 to 15 years on long distance petroleum pipelines (valves,

SKZ [expansion unknown]) are being outfitted with automation and remote control devices which make it possible to control their operation and run them from local and centralized control stations. The use of remote control devices makes it possible for the central controller to maintain optimal pumping regimes along the line and take care of any malfunctions at the station. Operational monitoring of the petroleum being pumped is handled by turbine-type counters instead of manual measurement on being pumped into the tanks.

Tank yards at head pumping stations have been made up in recent times of vertical metal tanks of large capacity, built on an industrial basis from panels manufactured under plant conditions. Tanks made of such billets are set up by means of automatic welding. Assembly of them is mechanized. As a result, the amount of installation work has been reduced and construction timetables shortened in the building of tanks.

The use of the block-component method of construction makes it possible to speed up the construction of pumping stations and put long-distance petroleum pipelines into operation more rapidly. Block-boxes are built and equipment is installed in them under plant conditions, then the block boxes are delivered ready-made to the site where they are hooked together to make up all the subsidiary-production facilities of the station. The block component method of construction is gradually being modernized and perfected.

In accordance with decisions of the 25th CPSU Congress, Glavtransneft' [Main Administration for Petroleum Transport] has mapped out a complex of measures designed to improve the economic effectiveness and reliability of petroleum pipeline transport operation, implementation of which calls for the following measures:

increasing the strength characteristics of the pipe metal while simultaneously reducing wall thickness;

improving the quality of anti-corrosion insulating coatings capable of extending the life of effective pipe protection against corrosion under various natural-climatic conditions;

extending the service life of pipeline electrochemical protection devices through the development and adoption of longer-life anode grounds, also on the basis of the extensive use of remote control of the operation of cathode protection devices;

adopting, in the practice of petroleum pipeline construction, the rigid method of hydraulic testing for 24 hours prior to being put into operation at a pressure which exerts on the pipe body a strain which is close to the yield limit of the metal, also repeated tests on existing petroleum pipelines;

converting to pumps with steel bodies and improved gasket systems, and replacing horizontal-type priming pumps, with bodies of the same make, with vertical ones for outside installation;

developing and adopting in practice high-RPM full-head pumping units with regulated pressure on the injection side and independent drive from a gas turbine for operation on routes running through uninhabited regions;

widely adopting the practice of monitoring the petroleum that is pumped by means of turbine type counters instead of measurement during pumping into the tanks;

making extensive use of automatic fire extinguishers in the pumping stations of long distance petroleum pipelines;

widely adopting the practice of running the operation of long-distance petroleum pipelines by means of remote control devices and ASU's [automated control systems].

Of considerable importance for the reliability of pipeline systems is high-quality factory production of block-module pumping stations and their adoption in the construction of petroleum pipelines.

Reliable operation of long distance pipelines being built depends not only on the quality of the project documentation of individual structural and equipment components going into the construction but also on the construction organizations' strict compliance with technical specifications governing the execution of each type of work in the construction process.

Compliance with these specifications will have an appreciable effect on the increased reliability of petroleum pipelines that are to be built during the Tenth Five-Year Plan out of pipes 820 to 1,220 mm in diameter in the northern areas of Western Siberia.

Further development and improvement of petroleum pipeline transport must be based on scientific-research and experimental-design projects. Of great importance in research work is the necessity of raising the level of automation and of developing reliable automation systems and effective automated control of long distance pipelines. It is essential to undertake organizational and technical measures to restructure the system of technical maintenance and repair on long distance petroleum pipelines on the basis of a centralized system of organizing equipment repairs and mechanizing repair operations on the line portion of the pipelines.

The successes achieved in the field of petroleum and petroleum product transport in 60 years have resulted from the goal-oriented and substantial labor of the many thousands of workers, employees, engineering-technical personnel, and scientific workers. Now, workers in the petroleum pipeline transport

system, scientific-research, planning institutes, and other organizations face the important task of assuring further technical progress in this sector.

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HISTORY, TECHNICAL DEVELOPMENTS IN SIBERIAN PETROLEUM

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 51-54

[Article by F. G. Arzhanov, chief of Glavtyumenneftegas: "Siberian Petroleum--Siberian Pace"]

[Text] The Soviet people and all progressive mankind are joyfully celebrating the successes achieved by our great homeland in 60 years of Soviet rule. The petroleum workers of Western Siberia, like all the Soviet people, are celebrating the glorious jubilee with new labor triumphs.

The petroleum industry in Western Siberia came into being relatively recently. As a result of stepped-up geological-exploration work for petroleum and gas in the post-war years in new regions of the country, especially Western Siberia, the first gas field was discovered near Berezovo in 1953, and 1960 marked the beginning of petroleum discoveries.

In connection with the long term organization of industrial petroleum field exploitation, Glavtyumenneftegaz [Main Tyumen' Petroleum and Gas Administration] was created in 1965; its collectives was assigned ambitious and responsible tasks: to create a petroleum producing industry in a short time under extremely difficult natural-climatic conditions, to build cities and settlements matching conditions of life in northern areas, to train the necessary cadres, to build field infrastructures on the modern technical level, to build highways and railroads, airports, river ports, and petroleum, gas, and water pipelines.

These complex problems had to be handled along with the accomplishment of intensive planned targets with respect to petroleum production which the country needed.

The great national-economic significance of developing the petroleum resources of Western Siberia and the magnitude of the work done, being done, and to be done required a special approach which involved a constant search for technical-technological and organizational-economic ways to rapidly boost petroleum production in a huge region distinguished by complex natural-climatic conditions.

A large portion of the territory of the petroleum fields there is covered with taiga, large and small lakes, swamps, and river plains characterized by prolonged flooding. Distances between fields run to hundreds of kilometers. There were no roads. Despite severe winters, the territory was passable only from late January to May.

Petroleum workers tackled the job of industrial field development without any tested recommendations or experience in developing the territory, organizing the drilling, and building the infrastructure under conditions similar to those of Western Siberia. In the first attempts to plan petroleum production in Western Siberia, they came up against a lack of experience in developing such territories on a large scale. One thing was clear--it would be impossible to base petroleum production planning on the experience of other petroleum regions of the country. In Western Siberia, the realization of many tested technical applications in the field of field infrastructure was impossible or extremely difficult.

The level of readiness for petroleum field development at that time is illustrated by the character of proposals that were submitted and examined as general directions. They included developing the fields by setting up a network of canals with floating rigs and field facility maintenance devices, draining the territory beforehand, building trestle roads and platforms for drilling and field equipment, partitioning off petroleum field territories from flood waters, using dirigibles and refraining from road building, conducting the work seasonally, and so on.

These and similar projects designed to radically resolve individual and sometimes several problems at the same time, for all their originality, possessed substantial shortcomings--despite considerable capital investments and other outlays they could not resolve the task as a whole, they might give rise to new difficulties, and--the main thing--they would drag on the region's development for a long time.

Having undertaken to develop the petroleum fields, the workers began to seek simpler and more economical solutions. The following plan for the region's industrial development was selected: based on existing experience, begin development from the most accessible sections without waiting for special recommendations and, as experience accumulated, work out technical applications suited to local conditions.

Experience showed that this plan proved to be the correct one. In six to seven years a reliable solution was found for the main problems that arose at the beginning of the development of the petroleum fields of Western Siberia. This can be judged from the following figures: seven years after development began, the annual increase in petroleum production exceeded 25 million tons, and in 10 years Western Siberia achieved the level of 150 million tons, with an increase of more than 32 million tons per year.

Rapid rates of petroleum production in Western Siberia were achieved through the adoption of the following radically new technical, technological, and organizational solutions:

Complete restructuring of the methods and nature of field construction on an industrial basis, using block equipment of high factory readiness;

development of special block-component automated equipment;

radical changes in the maintenance of field facilities;

development of a new, unitized technological system of petroleum field exploitation.

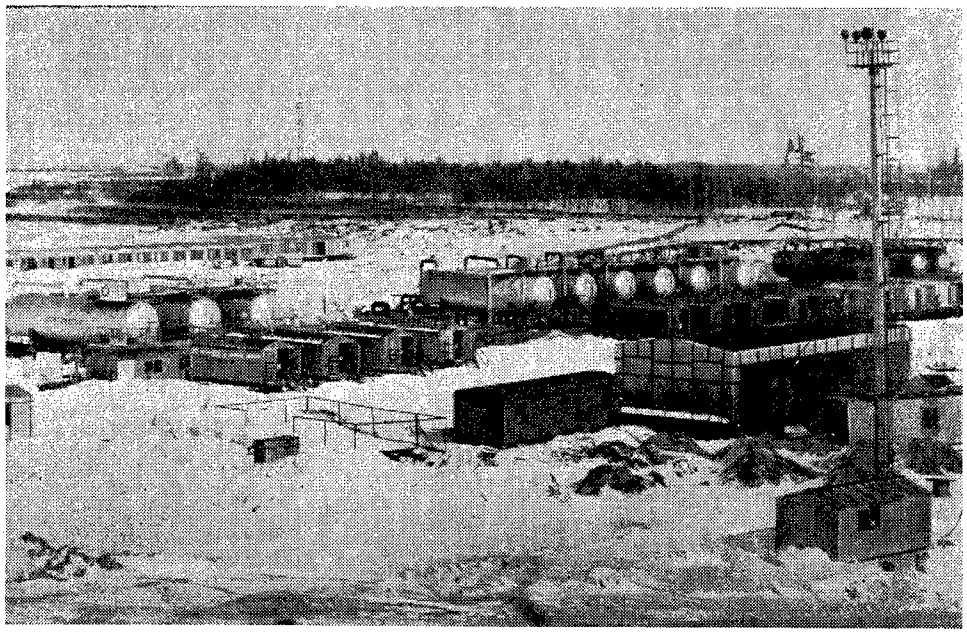
The new technical applications radically changed the nature and the very content of construction: costly work usually done in cases where there are no roads, no housing, and no industrial bases were replaced by industrial methods of installing block equipment of factory manufacture. As a result, construction timetables on field facilities were shortened by 2.5 to 10 times, and the cost of the work was reduced by 30 percent.

In Western Siberia, new principles of infrastructure were worked out and adopted: placing various-purpose field facilities on the same platforms, making it possible to reduce outlays on engineering preparation of the territory; corridor laying of utility lines; implementation of master infrastructure plans on the basis of maximum development and planning of the facilities, providing for further remodeling only on the basis of equipment replacement; extensive use of pile footings and mutli-level arrangement of equipment.

From the outset, the main problem in the development of Western Siberia's fields was that of doing away with seasonality in drilling, which was solved by working out and adopting a complex of technical-technological and organizational measures in the preparation of areas for drilling. Simplified drilling rig designs were adopted, making maximum use of local construction materials and cold weather, and the method of large-block construction of rigs in swamps and unstable soil. Also developed were tire-mounted vehicles, specially designed blocks for moving them through swamps, and mobile footings mounted on rails. The implementation of these measures in combination with the successful development of controlled directional drilling proved the feasibility and economic effectiveness of cluster well construction in Western Siberia.

In developing the petroleum fields of Western Siberia, petroleum workers, along with builders, planners, and scientific-research institute workers found simple and economical solutions to many problems; they worked out a number of progressive directions and acquired experience in the development of fields with minimum outlays in human labor and material resources. These involved primarily the priority introduction of major fields, the

adoption of effective exploitation systems, the introduction of fields into exploitation by segments while full exploration work was being completed, perfected methods of maintaining formation pressure, and so on.



Complex Collection Point

In accordance with the Main Directions of Development of the National Economy as mapped out by the 25th CPSU Congress, in 1980 Glavtyumenneftegaz is supposed to produce 310 million tons of petroleum as against 148 million tons in 1975, thus achieving an increase of 162 million tons over the five-year plan.

Accomplishing the tasks facing the petroleum industry of Western Siberia in the current five-year plan entails accelerating the resolution of many problems relating primarily to the task of sharply increasing work volumes and capacities of drilling, construction, petroleum production, transport, and other subunits.

The petroleum workers of Western Siberia completed the first year of the Tenth Five-Year Plan successfully. The 1976 production plan was fulfilled by 102.8 percent, and an increase of 33.6 million tons was achieved. Seven new fields went into production.

Western Siberia's petroleum workers are also doing good work in 1977. During the first half year they fulfilled annual socialist obligations with respect to production and well drilling.

Western Siberia's petroleum workers are observing their professional celebration with new labor triumphs. The eight-month petroleum production plan was overfulfilled.

Glavtyumenneftegaz enterprises took on new, higher socialist obligations: to boost above-plan production by another two million tons. In this way, 3.5 million tons will be produced above the plan in 1977.

The years of petroleum industry development in Western Siberia have witnessed the shaping of a remarkable collective of workers, engineering-technical personnel, and employees. Thousands of them have earned high awards with their labor: A. I. Suzdal'tsev (petroleum and gas production operator, Nizhnevartovskneft' NGDU [Petrolem and Gas Production Administration]), V. T. Gromov (drilling foreman, Nizhnevartovsk UBR [administration of drilling operations] No 1), M. F. Varlamov (underground well repair shop operator, Belozerneft' NGDU), I. S. Knyaz'kin (formation pressure maintenance operator, Yuganskneft' NGDU), N. N. D'yakov (tank yard chief of petroleum preparation and pumping shop, Nizhnevartovskneft' NGDU), R. M. Dobromysklova (storage yard operator, Surgutneft' NGDU), V. N. Belyayev (driller, Mamontovskoye UBR), I. V. Golubev (drilling foreman, Nizhnevartovsk UBR No 3), I. S. Sorochkin (electrician, SMU-1 [Construction-Installation Administration] of Nizhnevartovskneftestroy [Nizhnevartovsk Petroleum Construction Trust]), V. S. Glebov (drilling foreman, Nizhnevartovsk UBR No 2), V. V. Chugunov (drilling foreman, Nizhnevartovsk UBR No 2), A. Ya. Mironov (drilling foreman, Megion UBR), and others.

It is well known that any industrial sector must be evaluated by the potential of its development. In this regard, Siberia's petroleum land has enormous resources. For this reason, high rates of production over the long term, advances into regions farther north, and new problems that have so far not been studied, are confronting the collectives of Glavtyumenneftegaz with new tasks, in connection with which we have mapped out the main technical directions for the future.

1. Increased geological-exploration work.

2. Resolution of problems of developing vast water-petroleum and gas-petroleum zones.

3. Improvement of exploitation systems now in use: reorganizing facilities into smaller units; converting to denser networks; designing block, block-square, and area systems of activation with the mandatory delineation of each basic stratum as a separate object.

4. Extensive adoption of regulation of the exploitation process.

5. Stepped up efforts to boost well productivity: treatment of bottom-hole zones with surface-active agent solutions, methanol, and acid; improved drilling-in of productive strata through the use of invert emulsion solutions.

6. In drilling: the development of more efficient hydro monitor bits, the development of new bottom-hole engines, improved technology in well reinforcement, and increased capacities of drilling enterprises.

7. In production: enlarging the mechanized well inventory; implementing measures to boost the petroleum yield coefficient; resolving problems of seasonality in capital and underground well repairs and stepping up the pace of putting wells into operation in cluster drilling, and anti-salt and anti-corrosion measures; improving equipment reliability; and so on.

Western Siberia's petroleum workers are well aware of their responsibility for accomplishing the tasks of further developing the country's main petroleum producing base, and they are exerting all their strength, knowledge, and experience to successfully complete the targets of the current year and the five-year plan as a whole.

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PROGRESS, DEVELOPMENT IN KUYBYSHEVSKAYA OBLAST PETROLEUM

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 55-59

[Text] The Ural-Volga area is the country's main petroleum producing base. The first tons of industrial Volga petroleum were produced more than 40 years ago near Syzran' (Kuybyshevskaya Oblast). In Zhiguli, moreover, petroleum was produced for the first time from Devonian deposits; this launched the beginning of a fundamentally new direction in geological-prospecting and exploration work in this vast territory.

In the pre-war years, Kuybyshevskaya Oblast accounted for only 208,000 tons of petroleum.

The Great Patriotic War introduced substantial adjustments in the country's fuel balance. In the newly created petroleum bases, in particular "Second Baku," it was necessary to sharply increase production. In the summer of 1944, in well No 41 in Yablonovyy Ovrag, in Zhiguli, drilled by the crew headed by foreman (a party member) V. A. Rakov, a gusher of Devonia petroleum was struck. This confirmed a long-standing prediction by Russian scientists, especially Academician I. M. Gubkin, concerning the petroleum potential of the oldest Devonian deposits. This beginning of petroleum production in Zhiguli was a major labor triumph for the petroleum workers, a triumph won during a time when our homeland needed petroleum urgently.

After Kuybyshevskaya Oblast, Devonian petroleum was discovered in Bashkiria, Tataria, and Saratovskaya, Volgogradskaya and Orenburgskaya Oblasts.

On the basis of geological prospecting, the petroleum workers of Kuybyshevskaya Oblast predicted petroleum reserves in the Devonian and carboniferous horizons on the left bank of the Volga. In August 1955, at 3,000 meters in well No 38, drilled by the crew headed by foreman Sh. M. Kil'deyev in the Mukhanovskoye field, Devonian petroleum was struck, with an output of 300 tons per day. After the Mukhanovskoye field, in Devonian deposits and then in carboniferous horizons, petroleum was discovered in the neighboring Mikhaylovskaya and Kokhanskaya, and then in the Dmitriyevskaya and Sosnovo-Deryuzhevskaya areas.

An important event in the life of the oblast was the discovery of the Kuleshovskoye field.

Up to now, industrial petroleum in Kuybyshevskaya Oblast has been found in 55 strata coextensive with 32 stratographic horizons of the Permian, carboniferous, and Devonian systems at depths ranging between 500 and 3,500 meters. In a 40-year period, 516 petroleum deposits have been discovered in the oblast. The total volume of deep-well exploratory-prospecting drilling amounted to 6.5 million meters. Some 553 structures were delineated and prepared, and 398 structures were opened to exploration.

Despite the discovery of a large number of petroleum fields, prospects for increasing new petroleum reserves remain relatively high and are being realized under conditions of a high degree of completed exploration and complex geological structure of the territories as a result of shifting prospecting efforts into deeper-lying zones (exploration work has already been completed on structures of series 2). Kuybyshev petroleum workers have constantly sought out and perfected methods of developing new fields (Mukhanovskoye, Kuleshovskoye, Dmitriyevskoye, and others).

One of the main conditions helping to achieve a high level of production and the highest possible rates of extraction has been the use of advanced methods and systems of exploitation to maintain formation pressure. Especially effective is the method, adopted since 1960, of in-contour "logging" of deposits into blocks of optimal size.

Thanks to the widespread adoption of the method of intensive activation, at many sites, especially deep-lying Devonian deposits, 94 to 96 percent of the total petroleum output has been extracted by the flow method. Adoption of the block system during the early stage of exploitation in the deposit of stratum A_3 of the Kuleshovskoye field made it possible in 10 years to extract most of the recoverable reserves, and 97.6 percent was produced by the flow method.

For the scientific substantiation and practical adoption of advanced systems of exploitation, a group of production workers in the Kuybyshevneft' [Kuybyshev Petroleum Association] and scientific workers of Giprovostokneft' [Eastern State Institute for Planning and Research in the Petroleum Production Industry] were awarded the Lenin Prize.

Further improvement in the flooding method is being accomplished by increasing injection pressure, increading the volumes of injection, shifting the injection front, doing additional pocket flooding, and replacing fresh water with waste water. Also being widely adopted are more intensive three-row systems of exploitation and initial stage flooding. In recent years, traditional methods of maintaining formation pressure have not diminished in importance.

However, flooding methods in use are not resolving all problems relating to the rational use of natural resources. In Kuybyshevskaya Oblast, for this reason, much attention is being focused on the adoption of new methods of boosting petroleum yields. On the Orlyanskoye field, the country's largest industrial experiment has been underway since 1968, using polymer flooding. As a result, an additional 714,500 tons have been recovered; the economic effect comes to 4.5 million rubles. Compared with ordinary flooding, petroleum yields from two strata have been increased by 6.3 percent. By the end of exploitation, yields should rise by 10 to 12 percent.

For successful implementation of polymer flooding, a large group of scientific personnel in Giprovostokneft' and specialists of the association were awarded Academician I. M. Gubkin prizes.

In 1976, polymer flooding was begun in the Sosnovskoye field; by the end of the Tenth Five-Year Plan, this method is to be adopted at the Borovskoye high-viscosity petroleum field.

Increasing use is being made of the method of altering the direction of filtration flows; this method makes it possible to reduce the amount of water that is extracted, to improve reserve extraction conditions, and to increase the final yield by three to five percent. In 1977, five fields plan to produce an additional 250,000 tons of petroleum by this method. Preparatory work is underway on experimental sections for injecting micellar solution and using in-situ combustion.

The industrial experiments being carried out are preparing conditions for the widespread adoption of new methods of boosting petroleum yields in the future.

Along with the use of various methods for intensifying field exploitation, Kuybyshev petroleum workers are perfecting techniques and technologies of production. The extensive use of high-productivity units made it possible in the last five-year plan to produce an additional 4.5 million tons.

The achievement of high technical-economic indicators has been facilitated by the creation of a central production maintenance base for the repair and operation of electrical centrifugal pumps; this has made it possible to concentrate equipment and substantially boost its utilization, to work out and adopt advanced technologies for the repair of centrifugal pump assemblies, and to provide underground repair crews with units more efficiently.

A substantial amount of work has been done to determine optimal regimes and improve the operation of wells equipped with pumping jacks. In wells having a low productivity coefficient and a high gas factor, workers have begun to adopt highly-effective deep-well pumps with degassing chambers (NKR). In 1976 alone, more than 20,000 tons of additional petroleum were produced in 20 wells after these pumps were installed. For widespread adoption of NKR's it is necessary to organize their production in plant conditions.

Through the joint creative efforts of specialists of Giprovostokneft' and Kuybyshevneft', fundamentally new technologies and a complex of structures of the pressure-sealed system of petroleum and gas collection were developed and adopted in practice. The creation of this system proved to be a new and vitally important direction in the petroleum industry's scientific-technical progress.

Adoption of the transporting of gas-saturated petroleum made it possible to collect and prepare the petroleum at one point from a group of fields within a radius of 100 km or more, making it unnecessary to build small-scale collection points along with tank yards and petroleum preparation units at each field, and so on.

As a result of centralizing petroleum and gas collection and preparation facilities, it became unnecessary to build petroleum preparation units of two million tons productivity in the fields of the Kinel'-Cherkasskiy petroleum and gas region alone. This resulted in a savings of 11 million rubles. In addition, these facilities can now be operated at full load for longer periods; this boosts their effectiveness considerably.

The development and adoption of small-scale block separation units of large productivity have made it possible to enlarge petroleum field separation assemblies. This has made it possible to reduce capital investments necessary for the construction by three to five times, to sharply reduce volumes of construction-installation work, and improve operational reliability.

The achievement of a high level of production output in the oblast has been facilitated by the vigorous development of drilling equipment and drilling operational technology. Thus, Kuybyshevskaya Oblast was the first in the country to use the multi-shaft method of well drilling. The first Devonian double-shaft well in Zhiguli was drilled in the early 1950's by the crew headed by drilling foreman G. D. Tolstoukhov. For successful adoption and assimilation of this method, he and engineer G. N. Uspenskiy were awarded the State Prize.

The new method improved the economics of drilling, because it was controlled-directional, and it made it possible to prepare for drilling and exploitation strata lying under water, mountains, or forrests. Wells could be drilled from the banks of rivers, from forest clearings, and other convenient spots. The use of this progressive method made it possible to drill quickly, and with the least possible outlays, the Zol'nenskoye, Strel'nenskoye, Zhigulevskoye and other fields located under the Volga and the Zhiguli mountains. Between 1950 and 1960 in the oblast, more than 300 wells were drilled with two shafts, a total of 500,000 meters. The Kuybyshev way of multiple-shaft drilling was demonstrated at the World Industrial Exposition in Brussels and evoked considerable interest.

Cluster drilling is becoming perfected and more advanced. At present this method is being used to drill out the fields of Western Siberia and other petroleum regions of the country.

Kuybyshevskaya Oblast's petroleum industry, which came into being during the years of Soviet rule, holds a leading place in the country. At present, the oblast is producing more than 30 million tons every year. The oblast's petroleum enterprises have tested and adopted many progressive innovations and measures. Kuybyshev drillers are collaborating with workers in scientific-research organizations and machine builders on the large scale adoption and perfecting of various types of new equipment. They are constantly striving for effectiveness in social production and work quality.

Workers there, for example, were the first in the country to test and use the AKB-3 tongs, PKR-U7 pneumatic cotters, the ASP-111 unit, hydraulic cyclone units for cleaning the mud, smaller-diameter bits, light-alloy drill pipes, gas-turbine rig drive, hydraulically-operated rigs, electrically regulated bit feed, the SKU-2 drilling process control and operating station, powerful mandrel-type sectional turbo drills with braking grids, jet bits with hard-alloy fittings, and many other items.

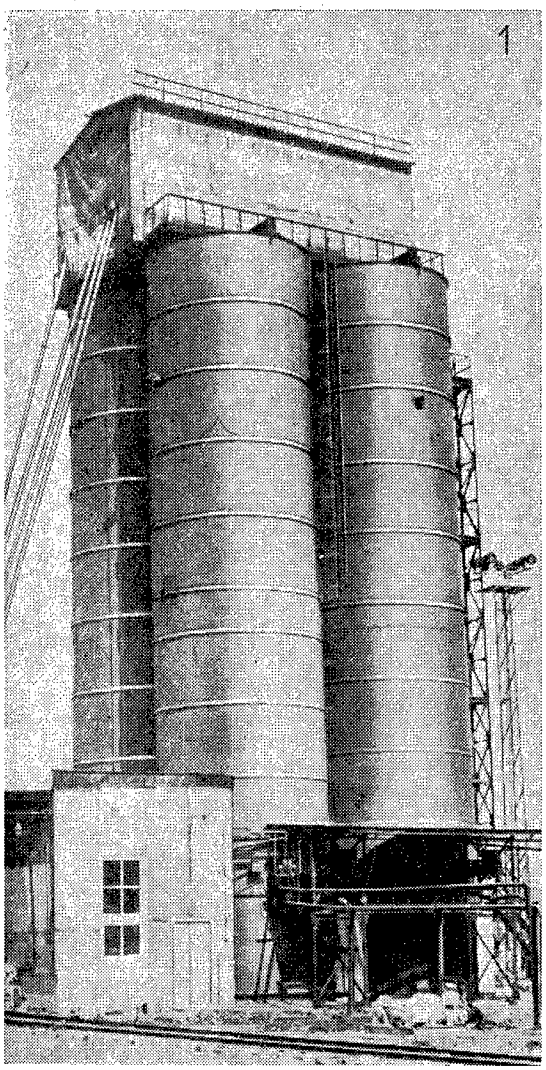
Recently (the last two or three years), the main focus in drilling has been on improving the technical-economic indicators of bit operation, reducing the amount of time spent in controlling drilling mud absorption, shortening the time it takes to put wells into operation and improving their quality, centralizing and mechanizing subsidiary shops and storage facilities--especially for bulk materials--and speeding up the time it takes to install or dismantle drilling equipment.

The petroleum producing industry is characterized by the fact that the planning and construction of field infrastructure facilities are ongoing throughout the entire exploitation period. This requires additional volumes of capital construction and capital outlays.

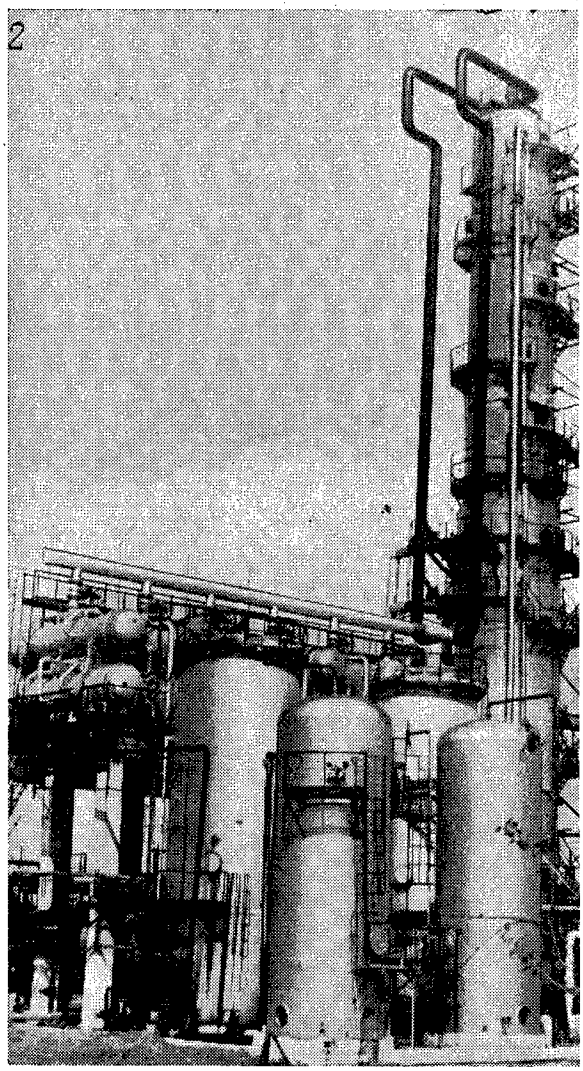
In order to maintain the high level of production from year to year throughout the association, production capacities are being increased. During the last five-year plan alone, 469 km of long distance petroleum pipelines, 253 km of long distance gas pipelines, and 209 km of 110/35 kilovolt power transmission lines were put into operation; eight RITS's [regional engineering-technical services] were automated and equipped for remote control.

The main thrust in construction is to shorten construction timetables, boost the effectiveness of construction work, and improve work quality. This is being accomplished through advanced technological applications, the adoption of scientific and technological developments, the use of industrial methods of construction, and the expanded use of block and block-component layouts.

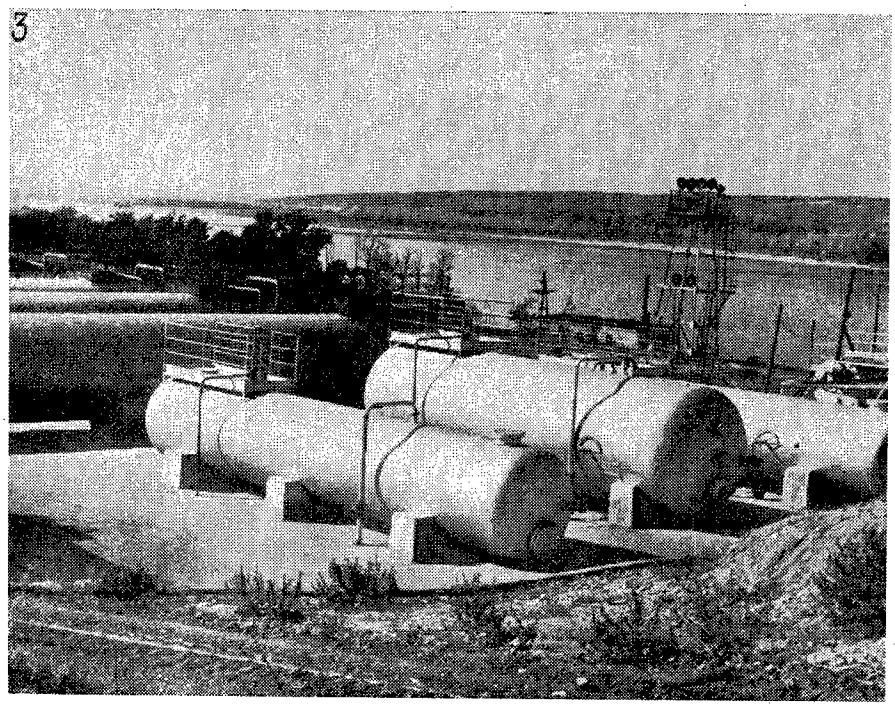
As a result of the development of Kuybyshevskaya Oblast's petroleum industry, new production sectors have come into being: petrochemistry and petroleum refining. One of its centers is in Kuybyshev. Located and operating there are scientific-research institutes and planning and specialized organizations interacting closely with petroleum workers. The petroleum industry has brought into being the cities of Zhigulevsk, Otradnyy, Neftegorsk, Pokhvistnevo, and others.



Mechanized Cement Storage in Otradnyy



Bogatovskneft' NGDU. Stabilization Block of Complex Petroleum Preparation Unit.



Zhigulevskneft'. Collection Point of RITS-2

The whole country has helped to develop the petroleum industry on the Volga. Much along these lines has been done, and continues to be done, by the oblast itself, in particular the city of Kuybyshev. The oblast center has sent hundreds of party members and Komsomol members to the petroleum fields, along with thousands of enterprise specialists, including those who have a higher or secondary specialized education.

Kuybyshevburmash [Kuybyshev Drilling Machinery Association] is providing these explorers of the depths with various bits and other drilling equipment. Repair and mechanical enterprises are lengthening the service life of petroleum equipment. The Metallurgy Plan imeni V. I. Lenin has mastered the production of light-alloy aluminum pipes for the drilling workers.

A complex of measures implemented by the association to improve the administration system in 1968 through 1975 made it possible to achieve an economic effect of more than four million rubles.

Since 1965, on the basis of the efforts and creative initiative of the workers, the association's subunits have been successfully perfecting and adopting the scientific organization of labor. At present, there are 24 NOT [Scientific Organization of Labor] social councils and 155 creative crews numbering 1,485 persons.

In efforts to conserve, collectives of the association's enterprises are taking active part in all union display contests of reserves of production and effectiveness of utilization of raw materials, supplies, and fuel-energy resources.

Over the past 20 years, an average of 4,000 rationalizations experts and inventors have taken part every year in creative activities. During that time they have submitted 87,600 proposals, of which 70,700 have been used in production. Between 1956 and 1976, production innovators saved the state 100 million rubles.

The best rationalization experts--V. V. Shirinya and A. P. Trubin of Pervomayneft' NGDU, A. S. Dvoretskiy of the Otradnyy UBR, and S. A. Akimov and N. I. Chunosov from the technological transport administrations--bear the honored title of "Meritorious Rationalization Expert of the RSFSR."

Within Kuybyshevneft', 21,966 persons are campaigning for a communist attitude toward labor; 12,112 persons have been awarded the title "Shock Worker of Communist Labor." The title "Collective of Communist Labor" has been awarded to the collectives of Zhigulevskneft' and Chapayevskneft NGDU's.

Petroleum industry workers completed the Ninth Five-Year Plan ahead of schedule and have got off to a good start on the Tenth. In 1976 they achieved 148,000 tons of above-plan petroleum, 64.6 million cubic meters of gas, sold 1.4 million rubles worth of above-plan products, drilled about 4,000 meters over and above the plan, and earned 980,000 rubles in above-plan profit. In competition for a worthy greeting to the 60th anniversary of Great October, the petroleum workers successfully completed the first half-year plan and produced more than 60,000 tons above the plan for their homeland.

For successful fulfillment of production indicators and adopted socialist obligations, the association's collective has been repeatedly awarded the challenge Red Banners of the Ministry of Petroleum Industry and the Central Committee of the Trade Union of Workers in the Petroleum, Gas, and Chemical Industry.

By the results of all-union socialist competition for ahead-of-schedule completion of the 1975 national economy plan and successful completion of the Ninth Five-Year Plan, the collective was awarded the challenge Red Banner of the CC CPSU, the USSR Council of Ministers, the AUCCTU, and the CC Komsomol, with the memorial badge "For Labor Valor in the Ninth Five-Year Plan."

During the Eighth and Ninth five-year plans and the first year of the Tenth Five-Year Plan, 1,071 persons in the association's collective were given governmental awards, including four who received the title Hero of Socialist Labor; 27 production leaders were made cavaliers of the Order of Lenin. Some 29 honored workers were given the title "Honored Petroleum Worker" by the Ministry of Petroleum Industry.

Since the start of the development of the petroleum industry in Kuybyshevskaya Oblast, the land along the Volga has yielded up 672.8 million tons. In collaboration with scientific workers, Kuybyshev petroleum workers are exerting all their knowledge and experience to maintain a high level of production of the "black gold" for the longest possible time and to extract the most possible petroleum from the ground with the least possible outlays.

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HISTORY, CURRENT DEVELOPMENT IN TATAR PETROLEUM

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 60-63

[Article by R. T. Bulgakov, general director of Tatneft' imeni V. D. Sashin: "To Greet the Jubilee"]

[Text] The beginning of the discovery of the first industrial petroleum in Tataria was launched by well No 1, drilled near the village of Shugurovo on 3 August 1943 by the crew headed by foreman G. M. Khamidullin, under difficult wartime conditions; the discovery of the Romashkinskoye and other petroleum fields launched the creation of one of the leading petroleum regions of the country in Tataria.

A large contribution to the discovery of Tatar petroleum was made by drilling crews headed by foremen S. Kuz'min, M. Gimazov, M. Nurgaleyev, M. Beloglazov, S. Baklushin, A. Yudin, and G. Gayfullin; also petroleum production crews headed by foremen K. Valeyev, S. Kopalin, and Sh. Motygullin; also petroleum production operators M. Sarimov, M. Farkhutdinova, and many others.

Tatneft' [Tatar Petroleum Association] was created in 1950.

The whole country helped in establishing Tataria's infant petroleum industry. By directive of the CC CPSU, experienced specialists from many petroleum regions were sent to the republic's fields. From Bashkiria came A. T. Shmarev, V. D. Shashin, State Prize Zinner and one of the discovers of the Tuymazinskoye field V. M. Mal'tsev, and A. D. Obnosov; from Groznyy came S. L. Knyazev, P. S. Vasil'yev, V. A. Yeronin; from Azerbaydzhan came T. F. Rustambekov and R. A. Sumbatov; from Sakhalin came Ye. I. Shvetsov; from Perm' came K. I. Ponomarev and dozens of other engineers who made major contributions to the development of the republic's petroleum industry.

A large petroleum production base was created in the republic.

In recent years the republic's ground has yielded up more than 1.6 billion tons of petroleum; more than 700 million tons of top quality have been prepared for the country's refineries; high technical-economic indicators have been achieved in petroleum field development and exploitation, well drilling, and other kinds of activities.

These successes have been achieved through the large-scale and systematic efforts exerted by the association in close cooperation with scientific organizations involved in the technical-technological and organizational improvement and intensification of production.

A major contribution to Soviet petroleum field operation theory and practice was the introduction of contour flooding, developed by workers of the association and the VNII [All-Union Scientific Research Institute], which was given the Lenin Prize in 1962. Named as Lenin Prize Winners were F. A. Begishev, P. S. Vasil'yev, R. Sh. Mingareyev, M. M. Ivanova, A. P. Krylov, Yu. P. Borisov, A. N. Buchin, O. I. Dorokhov, M. I. Maksimov, A. P. Choporov, V. A. Kalamkarov, and A. T. Shmarev.

Here in Tataria, labor careers were begun and much effort, skill, and creative initiative was invested in improving the equipment and technology of production processes by R. Sh. Mingareyev, U. G. Sattarov, V. I. Mishchevich, A. V. Valikhanov, V. I. Grayfer, N. A. Mal'tsev, V. I. Igrevskiy, I. V. Gundortsev, V. Ye. Batashov, V. Yu. Filanovskiy, S. G. Skripnik, Yu. G. Apanovich, Yu. V. Vadetskiy, and many others.

A substantial contribution was made to the development of the theory of petroleum science, and large numbers of specific recommendations were given, by G. G. Vakhitov and N. N. Neprimerov, TatNIPIneft' [Tatar Scientific-Research and Planning Institute for Petroleum] workers R. A. Maksutov, S. A. Sultanov, S. N. Shan'gin, V. P. Tronov, V. I. Krylov, and V. G. Gerasimov.

Accumulated experience in petroleum field exploitation made it possible in subsequent years to map out the main directions of scientific-research and industrial projects to perfect existing and create new effective methods of petroleum recovery. The use of flooding constituted a powerful means for boosting production intensively in Tataria. Projected levels of production were achieved and surpassed in main fields.

One of the main tasks facing petroleum workers is that of making full use of geological petroleum reserves. This problem is resolved both by perfecting methods of exploitation and by developing and introducing new methods of boosting the yield--physical-chemical, thermal, and hydrodynamic.

In recent years, the association has industrially tested about 10 new methods of boosting yields--methods developed by TatNIPIneft' and other sector institutes. Among them, the most widespread is the in-situ sulfonation method. As of early 1977, more than 120,000 tons of sulfuric acid had been pumped into productive strata; in the future, this will yield an additional six million tons or so.

Since the mid-1960's, there has been a sharp increase in the amount of work done to convert wells to mechanized operation. This has been dictated primarily by the necessity of intensifying production by reducing bottom-hole pressure, by the rise in the water content of the petroleum extracted, and by the fact that low-productivity peripheral areas were put into production.

In addition to the growth of the mechanized well inventory, qualitative changes have taken place because of the increase in the number of wells operated by high-efficiency and high-pressure pumps. Between 1966 and 1976, recovery from mechanized wells increased from 27.7 to 94 percent.

Under conditions of the steady rise in recovery due to the mechanized method of well exploitation, one of the main directions in technical policies of petroleum recovery is the optimalization of the technological regime of operating pump wells. In collaboration with scientific organizations, the association has developed and is widely adopting computer-based programs for selecting ShGN [? sucker-rod pump] and ETsN [electrical centrifugal pump] equipment for wells. Their use provides an annual economic effect of two to three million rubles.

One of the main characteristics of the present stage of petroleum field exploitation in Tataria is the increased role played by current and capital well repairs and stepped-up efforts on the well inventory to boost the uniformity of reserve recovery. This is due to the quantitative rise in the well inventory, changes in its structure, and more complicated operating conditions.

Despite the fact that in the Ninth Five-Year Plan alone the number of current and capital well repairs rose by more than 1.7 times, repair capacities that have been created are not meeting production needs. Under such conditions, the association's efforts have been directed toward further specialization and concentration of repair services and improved effectiveness in their work.

The association is seeking out and adopting methods for sharply reducing the amount of repair time in insulation and other work. Substantial increases in labor productivity are being achieved through the use of the association's own express methods of insulation using cables.

For restoring and increasing the productivity of petroleum and injection wells, widespread use is being made of physical-chemical and thermal methods of activating the bottom-hole zone: thermal-gas-chemical activation, in-situ thermo-chemical treatment using granulated magnesium and muriatic acid, mud acid, sulfuric acid, and muriatic acid treatment, and the injection of solvents. Thanks to these measures, about 1.5 million tons of additional petroleum are being recovered every year, and more than 4.5 million cubic meters of water are being injected into productive strata.

In the last 10 years, radical changes have taken place in the technical-technological base of the petroleum and gas collection system. Instead of a gravity-feed system, with its large number of objects to be maintained, use is made of a high-pressure sealed system with block automated technological installations. In 1966, only three block automated facilities were put into operation; more than 1,000 have been installed in subsequent years.

The extensive adoption of industrial methods of construction has made it possible not only to build up new fields on the sealed pattern but also to do a substantial amount of work on rebuilding petroleum and gas collection systems on fields already in production. As of early 1977, 99 percent of the association's wells were operating on the sealed system; the utilization of casing-head gas stood at 95 percent.

Considerable work is being done on the construction of first and second separation stage assemblies of storage yards. Petroleum-gas separators are being introduced, with preliminary removal of the gas, and helical compressors for removing the gas in the terminal stages of the separation.

Relatively recently, a completely new sector came into being in the production fields--field preparation of the petroleum, in which petroleum turned over to the suppliers has been brought up to standard, free of water and salt. This method is now being used to prepare practically all the petroleum reocvered in Tataria.

Because of the sharp increase in volumes of petroleum recovery and the water content of the petroleum, lags in the construction of capital-intensive facilities for removing water and salt and, as a consequence, a substantial deficiency in preparation capacities, production workers and scientists are focusing most of their attention on the task of improving preparation process flow patterns, on seeking out effective and economical ways to sharply reduce the delivery of non-conditioned petroleum.

As a result of scientific-research and experimental-industrial projects, the processes of petroleum demulsification, collection, and transport have been combined. The new technology permits multi-purpose utilization of field equipment necessary at all stages of exploitation, and thereby makes it possible to sharply reduce the gap between increased petroleum recovery and preparation capacities.

Thanks to the widespread utilization of methods of combining petroleum preparation and the operation of rigs in a block with the field petroleum and gas collection system, projected productivities of the units have been surpassed by almost 20 percent.

A number of water-removal units with an annual capability of 13 million tons have been converted to the salt-removal mode practically without any additional capital investments.

All of this has made it possible, between 1966 and 1976, to increase the proportion of high-quality desalinated petroleum from 39.2 to 71.8 percent and to reduce the average inert material content in the overall petroleum delivered from 1.3 to 0.2 percent.

The development of block automated equipment, the unitization of the technological system for the recovery, collection, and preparation of petroleum, gas, and water making maximum use of stratal energy or pressures generated

by submerged units, and reducing to a minimum the number of dispersed facilities, have made it possible to successfully resolve the problem of integrated automation of petroleum and gas producing enterprises on a new qualitative basis.

As of 1 January 1977, the association had put into production 31 integrally automated petroleum production RITS's [regional engineering-technical services], accounting for more than 92 percent of all petroleum recovered.

An extremely important problem being worked on by Tataria's petroleum workers is that of improving the utilization of facilities and technological equipment and increasing their reliability. Thanks to optimalization of the operating regimes of the mechanized well inventory, the adoption of refractory-lined pipes, and improved quality in operation and repairs, it has been possible over the past 10 years to expand by 1.8 times the period between repairs on mechanized wells.

In connection with the rise in the use of waste water in the formation pressure maintenance system--from 2.4 percent in 1966 to 76.9 percent in 1976--considerable work is being done in collaboration with the scientific organizations for the use of corrosion inhibitors and the protection of equipment and pipelines by means of various coatings. Between 1971 and 1975, the introduction of these measures made it possible to reduce the accident rate per km of waste water pipeline by more than 3.5 times.

The successes achieved by the association have resulted from the considerable organizational efforts of party, trade union, and Komsomol organizations, the selfless labor of all the petroleum workers, extensive involvement in socialist competition for upgrading the effectiveness of social production, for high-quality and ahead-of-schedule completion and overfulfillment of assigned tasks.

Substantial labor triumphs have been made in the association by the Al'met'yevneft', Aznakayevskneft', Yelkhovneft', Suleyevneft', and Prikamneft' NGDU's [Petroleum and Gas Production Administrations], by the Al'met'yevsk and Aznakayevsk UBR's [Administration of Drilling Operations], the Al'met'yevsk administration for boosting stratal yields, by drilling crews headed by foremen Hero of Socialist Labor G. Khaziyev, D. Nurutdinov, and M. Grin', well repair crews headed by foremen State USSR Prize Winner A. Abdullin, A. Yevdokimov, T. Faskheyev, V. Sherstobitov, A. Sinchurin, and other collectives.

During the Tenth Five-Year Plan, the republic's petroleum workers face difficult and responsible tasks: it is essential to insure completion of the petroleum recovery plan, to implement a complex of measures designed to improve the utilization of reserves and the well inventory, and to improve the effectiveness and quality of the work in all segments of production. These tasks must be accomplished under conditions of the transition of highly-productive fields into the late stage of exploitation, the

introduction of a large number of small fields producing petroleum of high viscosity and aggressiveness, obsolescence of the well inventory and the technological equipment, and increased essential volumes of more labor-intensive repair work.

A characteristic feature of the association's activities in the Tenth Five-Year Plan is the formulation of programs to improve the utilization of petroleum reserves, to develop methods of working asphalt deposits, to protect the environment, and other efforts in order to fully and effectively resolve the problems facing the republic's petroleum industry.

Tataria's petroleum wokrers are striving to celebrate the jubilee year of 1977 with new labor triumphs. All of the association's subunits are introducing various kinds of collective and individual competition under the slogan "For a Worthy Greeting to the 60th Anniversary of Great October."

Having examined its capabilities and reserves (further improvement of petroleum field exploitation, integrated automation of field facilities, increased stratal yields, improved work on well inventories), the association's collective has adopted the obligation of producing 250,000 tons of petroleum above the state plan during the second year of the Tenth Five-Year Plan, including 200,000 tons by the 60th anniversary of Great October.

Petroleum workers are proud of the fact that the association has been given the name of V. D. Shashin, who has invested much strength and energy in the rise and development of Tataria's petroleum industry.

The results of 1976 and the first months of the jubilee year testify to the fact that despite certain difficulties the collective of the republic's petroleum workers will make a worthy contribution toward implementing the ambitious program of the Tenth Five-Year Plan; it will do everything it can to greet the 60th anniversary of Great October with new labor triumphs.

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DEVELOPMENT OF THE PETROLEUM TRANSPORT, STORAGE SECTOR

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 63-66

[Article by I. M. Torochkov, L. A. Matskin, and V. V. Razumov (RSFSR Glavneftesnab): "Development of Transport and Storage of Petroleum Products in 60 Years"]

[Text] In 60 years of existence, the petroleum product transport and storage sector has been transformed into an intricate technical-economic complex which incorporates a number of closely related production links of petroleum recovery and refining, a petroleum supply transport-storage network, both in operation and under development, and practically the entire national economy as a consumer of petroleum products.

It is of interest to consider the work of the sector during the Civil War and the Great Patriotic War, period of disruption, during the restoration period, and under conditions of peacetime economy.

A crucial factor in the sector's development during each period has been the level of petroleum recovery and refining and their deployment on the country's territory as the basis of the development of a pipeline and storage network called upon to provide systematic movement of petroleum products to places of consumption.

In czarist Russia, 75 percent of the petroleum was produced in the Baku region and 20.5 percent in the Groznyy region, where it was also refined. The main commercial products at that time were lighting kerosene (24 percent) and petroleum for fuel (76 percent).

Because of the backwardness of the transport structure (87.2 percent was transported by sea, 11.8 percent by rail, 0.01 percent by pipeline, and 2.0 percent by horse-drawn wagon), the concentration of petroleum product resources created a most difficult problem for delivering them to places of consumption.

Before the Great October Socialist Revolution, the marketing of petroleum products in Russia was handled by privately-owned petroleum firms. The

czarist government attempted to regulate this. Thus, it created the OsoTOP [Special Fuel Conference], which helped in supplying fuel to the railroads and meeting the needs of the war industry. Later on, maximum prices were declared which were obligatory on deliveries of petroleum fuel to all consumers.

After the petroleum industry was nationalized, the regulation of its operations and marketing activities, including the organization of storage facilities, became the responsibility of Glavkoneft' [expansion unknown].

The years 1919-1920 were characterized by an intense petroleum famine. Fuel reserves in the country came to only 30,000 tons. The exceptionally difficult situation with respect to petroleum fuel is indicated by V. I. Lenin's telegram to the Volga Revvoyensovet [revolutionary military council], sent in 1919: "In view of critical liquid fuel situation, it is prohibited, on pain of strict accountability, for anyone to expend or release liquid fuel without authorization of Glavneft' [Main Administration of the Petroleum Industry]. Anyone guilty of arbitrarily seizing and dispensing liquid fuel will be immediately turned over to the revolutionary court." ("Leninskiy sbornik" [Lenin Collection], XXIV pp 71-72).

In April 1919 he telegraphed the following to the Astrakhan' Revvoyensovet: "... Discuss immediately: first, is it not essential to speed up the taking of Petrovsk in order to transport petroleum from Groznyy; second, is it not essential to take the mouth of the Ural and Gur'yev in order to seize petroleum from there; need for petroleum desperate. Direct all efforts toward prompt acquisition of petroleum and inform in detail by telegraph." (V. I. Lenin, "Complete Collected Works," Vol 50, p 288).

The year 1921 saw the beginning of the NEP [new economic policy], which required restructuring of the administration of the national economy. In order to implement all the measures required for the sale of petroleum products under the new conditions, Neftetorg [Petroleum Trade] was organized in 1922; subsequently, this became Neftesindikat [Petroleum Syndicate], Glavneftesbyt [Main Administration for the Marketing and Transport of Petroleum and Petroleum Products], RSFSR Glavneftesnab [Main Administration for the Transport and Supply of Petroleum and Petroleum Products], and the Glavneftesnabsbyts [Main Administrations for the Marketing, Transport, and Supply of Petroleum and Petroleum Products] of the union republics. The same period saw the formation of the interdepartmental calculation-commercial norm-setting commission, which set prices on all types of fuel and petroleum products. The work of this commission later served as the basis for the fuel industry's conversion to cost accounting.

In 1921, the Soviet state began to trade petroleum products with foreign countries. In March of 1922, Nefteeksport [State Association for Marketing Petroleum Products Abroad] was set up under Narkomvneshtorg [People's Commissariat of Foreign Trade] to handle foreign trading and petroleum and petroleum products. In subsequent years, the Export Administration

was set up under Neftesindikat; after that, however, problems of petroleum and petroleum product trading were transfered to the jurisdiction of the foreign trade organizations.

Considerable work was done to restore and develop petroleum storage operations, which in 1922 included and operated 1,211 petroleum depots with a total capacity of 4.5 million cubic meters in 611 locations. The main task was to concentrate these scattered, small scale petroleum storage facilities. In 1923, 40 small petroleum storage facilities in the southwestern regions were consolidated into 26 petroleum depots, and by 1926 the number of operating petroleum depots already stood at 618 in 563 locations. In 1927-1928, Neftesindikat had within the country 20 petroleum product marketing offices incorporating 850 petroleum depots.

By 1927, the delivery of petroleum products to domestic markets had risen by 3.8 times compared with 1913, and by 1932 it had risen by 1.2 times compared with 1927. This was facilitated by the general achievements of the petroleum industry, which fulfilled the First Five-Year Plan in 2.5 years.

The number of petroleum depots by that time stood at 1,027; the concentration of storage facilities was complete. Work was being done on technical improvement of the depots. For example, a standard was adopted for vertical cylindrical valve tanks of 11 through 10,560 cubic meters capacity. The introduction of this standard imposed order on the construction of tanks. By 1937, the country already had 1,520 depots; vertical cylindrical welded tanks of up to 5,000 cubic meters capacity began to be introduced.

In order to insure normal supplies of petroleum products to newly created sovkhozes and MTS's [machine-tractor stations], especially in the eastern regions and individual republics, the CC VKP(b) [All-Union Communist Party (Bolshevik)] and the Council of People's Commissars in a decree dated 10 February 1936 "Providing Agriculture with Ligroins in 1936 and the Operation of KhTZ [Khar'kov Tractor Plant] Tractors" directed Soyuzneftetorg [All-Union Petroleum Trade] to build an additional 200 depots and to increase the capacity of tank yards at existing depots by 200,000 cubic meters.

During the pre-war five-year plans, in addition to building new depots, old ones were rebuilt and modernized. By that time, the total number of depots stood at 1,686, and the tank yard capacity stood at 8.5 million cubic meters. Domestic petroleum products consumption in 1940 had risen by 1.5 times over 1937, and by 4.29 times over 1913.

Thus, formerly backward Russia, which predominantly consumed unclarified petroleum products (70 percent), was transformed during the years of Soviet rule into a leading, powerful country, where the proportion of refined fuel and oil consumption rose from 24 percent in 1913 to 55 percent of the total products consumed in 1940. By the beginning of the Great Patriotic War, the country's economy had become considerably stronger. The country's

transport system comprised a powerful, integrated network. The productivity of existing long distance pipelines, converted to terms of 200-mm diameter pipelines, had increased by 6.7 times compared with the pre-revolutionary period.

As a result of the military operations of 1941-1945 and the temporary occupation of some regions of the USSR, Glavneftesnab's petroleum product storage and pipeline operations sustained considerable damage. Out of the total of 1,686 depots in operation before the war, about 750 were destroyed and partially damaged. The Groznyy--Trudovaya long distance pipeline--880 km in length--was put out of commission, along with more than 2.2 million cubic meters of tank capacity; this figure included 1.2 million cubic meters capacity completely destroyed.

Restoration of petroleum depots in regions liberated from fascist occupation forces by the Soviet army preceded restoration of all other sectors of the economy. In late 1941, restoration work began in Tul'skaya and Moscow Oblasts. The GKO [State Committee for Defense] published a number of decrees stipulating the essential practical measures to be done in this direction, and provided material aid to Glavneftesnab.

In autumn of 1942, during the bloody battles for Stalingrad, the GKO published a decree dated 14 October 1942 on restoring the destroyed and fire-damaged Astrakhan' transloading depots. Glavneftesnab sent special crews to Astrakhan to do the restoration work; they were to determine the amount of work to be done and organize its execution. Decisive steps were taken to restore the long distance Groznyy--Rostov pipeline.

During the days of the Leningrad blockade, the city's petroleum suppliers demonstrated great selflessness, endurance, and staunchness, Mobilizing the Soviet army required the supply of petroleum products to troop units being formed. Leningrad's petroleum base successfully carried out this mission. During the second half of 1941, 43 percent of all petroleum products at the disposal of the Leningrad administration of Glavneftesnab were turned over to the Soviet army.

Petroleum products practically ceased to come into Leningrad after July 1941. In September of 1942, by decision of the Military Soviet of the Leningrad front, supplies of petroleum products were distributed. In addition to storage facilities in the city's enterprises and yards for the storage of oil in cans and containers, this required the use of rail tank cars. On 18 September 1941, the Military Soviet passed a decree on strict economizing in the consumption of automotive gasoline.

Until the end of the blockade, petroleum products were issued in accordance with norms drawn up by the Leningrad administration of Glavneftesnab in collaboration with Gosplan authorities and approved by party and soviet bodies or the Military Soviet.

After the ice formed on Lake Ladoga, petroleum products were brought in by military highway, and in the spring of 1942 a pipeline was laid 21.5 km under the water at depths down to 12 meters (the total length was 30 km). On 17 June, the first few tons of kerosene were pumped through the pipeline. From that day on, the supply of refined petroleum products to the blockaded city was insured a technical base. For this work, the chief engineer of the Leningrad administration of Glavneftesnab, I. N. Vorotnikov, received government awards.

During the air attack on the Krasnyy Neftyanik petroleum depot on 5 September 1941, a total of 100 incendiary bombs were dropped. After the blockade was lifted, decisive steps were taken to restore the damaged storage facility.

The same kind of selfless efforts during the war were demonstrated by the petroleum suppliers of the Astrakhan, Makhachkala, and other petroleum bases.

During the post-war period 1946-1950, the petroleum depot operation, being one of the most important links in the USSR's petroleum supply system, was restored and rebuilt on the basis of resolving the following basic tasks: full restoration of the destroyed facilities, but on a higher technical level, in regions of the country liberated from German occupation; further development and modernization of existing depots located in rear areas, in particular the Urals and Siberia, in connection with the relocation of numerous petroleum-consuming industrial enterprises to these regions, and also development of the network of depots in Eastern Siberia and Khabarovskiy and Primorskiy Krays.

Until 1950, the depots were restored and rebuilt chiefly with an eye toward speeding up the reintroduction of capacities in order to provide supplies of petroleum products. During the period of upsurge in transport-storage operations under conditions of peacetime economic development (1951--1977), pipeline transport of petroleum products has undergone intensive growth. The following petroleum product pipelines have been being built: Ufa--Omsk--Novosibirsk, a total of about 3,000 km of 529 mm diameter; Kuybyshev--Bryansk, 1,137 km in length, 529 mm in diameter; and others. Continuous improvements are being made in work on long distance pipelines, the technical equipment level is rising, and work effectiveness is improving. In particular, we have developed the technology of sequential pumping of various grades of petroleum products through a single pipeline, both in direct contant and with mechanical dividers. This kind of pumping makes it possible to utilize pipeline capacity more fully.

Mechanized and automated processes are being used in pumping petroleum products through pipes. In order to insure accident-free operation, a complex of measures is being implemented to protect them from corrosion. Work is being done on adopting ASU's [automated control systems] on petroleum pipelines as component parts of petroleum product supply ASU's.

As has been mentioned, the development and remodeling of existing depots and the construction of new ones all these years have been dictated chiefly by the rise in production and consumption of petroleum products.

In 1960, in connection with the development of automotive transport, RSFSR Glavneftesnab put 1,993 petroleum storage facilities into operation, chiefly to supply agriculture, also automotive service stations belonging to various ministries and departments. In connection with this, a large complex of work was carried out to consolidate and remodel petroleum storage facilities; this helped to improve petroleum product supplies.

Large transloading depots were built, provided with large tank yards and the latest technological equipment (highly-productive pumping units, an elaborated network of technological pipelines, scrubbing facilities, mechanization and automation devices for technological processes, using computer equipment, and so on) in the Baltic area (Klaypeda, Ventspils), the Far East (Nakhodka), on the upper Lena (Ust'-Kut), and so on.

In connection with the enormous scale of construction work, such as, for example, the building of the BAM [Baykal-Amur Railroad], it has become necessary to set up mobile railroad petroleum depots.

As of the end of 1976, the number of stationary automotive service stations stood at 4,600, while the number of mobile stations stood at more than 1,500. Considerable work was undertaken to improve automotive service equipment and to seek out ways to industrialize construction and mechanize and automate processes of fueling automotive transport.

The draft of the Constitution of the Union of Soviet Socialist Republics points out that the state is concerned for improved working conditions and reducing--and later on fully doing away with--heavy manual labor on the basis of integrated mechanization and automation of production. In order to accomplish this on long distance pipelines, in petroleum depots, and in automotive service stations, considerable work will have to be done.

In the 60-year period, the petroleum products transport and storage sector has grown immeasurably. Its material-technical base has become strong. The technical level of long distance pipelines, depots, and automotive service stations has come to match modern standards.

A network of machine building plants has been set up to produce a large assortment of machinery, mechanisms, instruments, tanks, fittings, and other items for supplying the needs of economic subunits.

Large scale scientific-research, design, and project work is underway to improve technical levels, process mechanization and automation, to insure environmental protection, to prevent petroleum product losses, and to draw up project-estimate documentation for the construction of new facilities, and so on.

The CC CPSU, the USSR Council of Ministers, the AUCCTU, and the CC Komsomol in their appeal "Improving the Use of Production Reserves and Strengthening Conservation Regimes in the National Economy" have called upon enterprise and organization collectives to be more diligent in getting raw materials and wastes into production. This is of direct relevance to petroleum and petroleum products. Careful consumption of them, efforts to reduce unproductive losses, and recovery for purposes of recycling are extremely important to conservation.

For purposes of upgrading the level of work involved in the recovery and secondary utilization of petroleum products, making additional petroleum resources available for refining, and strengthening efforts to prevent contamination of the environment by spent petroleum products, an association was set up in 1975 for the collective, recovery, and rational utilization of spent petroleum products--Vtornefteprodukt [Secondary Petroleum Products] (based on Regotmas [All-Union Office for Regeneration of Used Petroleum Lubricants] under RSFSR Glavneftesnab. In the time since then, this association has produced real benefits. The collection and utilization of spent petroleum products has increased sharply; regulatory rules have been instituted governing the receipt of fresh petroleum products on condition of turning over spent ones, and so on.

The many-thousand member collective of the petroleum products transport, storage, and distribution sector are making maximum effective use of their available equipment and capacities to further develop the country's economy and improve the people's well being.

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DRILLING TECHNOLOGY DEVELOPMENTS IN THE NORTH CAUCASUS

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 67-70

[Article by V. V. Petrov (Grozneft'): "Chechen-Ingushetia's Drillers in the Campaign for Technical Progress"]

[Text] The drillers of one of the oldest petroleum regions of the country have traveled a glorious labor road during the years of Soviet rule.

At the initiative of drilling foreman P. Ye. Yezhkov and A. N. Saakov, backed up by petroleum administration chief I. V. Kossior, the rotary drilling method was introduced for the first time in Groznyy. As a result of the adoption and development of leaders in high speed well drilling, foremen A. M. Ryabov, G. P. Sal'nikov, S. Baydayev, A. D. Batyukov, and Ya. G. Subbotin, the rate of operational drilling was raised to 680 meters per rig-month in 1935.

The shock work labor of the leading crews made it possible during the first five-year plans to discover and begin the drilling-out of a number of new fields in a short time: Malgobek (1933), Goragorsk (1937), the subthrust in Staropromyslovskiy Rayon, Oysungur, and Achi-Su (1935), and Izberbash (1936).

In 1934, the first experiments were conducted on drilling directional-controlled well No 2-50 in Staropromyslovskiy Rayon, and in 1937 the decisions was made to convert completely to this method of well drilling. For this, use was made of the removable whipstock and hydraulic whipstock developed by Groznyy engineer A. P. Cheremin.

In 1938, for the measurement of large angles of well deviation, workers started to use the MChS [expansion unknown] inclinometer developed by geophysicists G. S. Morozov, V. K. Chernousov, and G. N. Strotskiy. Groznyy engineers A. N. Shan'gin and N. A. Kuligin proposed a new method of orienting the drilling tool with whipstocks. In 1939, in Starogroznenskiy Rayon, they drilled the world's first controlled-directional well, No 2-975, by the turbine method, using a bent pipe as the whipstock. In subsequent years the method came into widespread use. The conversion to turbine drilling made it possible to sink directional and spiral-controlled wells.

Considerable credit in the development of directional drilling goes to engineers N. A. Kuligin, A. P. Cheremin, A. N. Shan'gin, K. I. Loshkarev, G. M. Ramm, V. B. Nazarov, Ya. A. Gel'fgat, A. I. Pashalov, and others. This complicated drilling method was successfully mastered by S. Ye. Slesarev, S. M. Svintsov, G. L. Afanasov, G. L. Maletskiy, V. S. Svintsov, P. G. Izyumskiy, I. M. Shulikin, and others.

By the mid-1950's, when petroleum recovery declined in the Karagano-Chokrakskiy deposits, the Checheno-Ingushskaya Oblast party organization assigned the Groznyy petroleum workers a difficult and responsible task--that of expanding geological-prospecting work, finding new fields of petroleum in deep-lying mesozoic deposits, drilling in which was distinguished by exceptional difficulties, and reaching great depths in a short time.

Thanks to the selfless labor of the Groznyy geologists, drillers, petroleum specialists, and scientists, deep well No 16, drilled on the Karabulak-Achalukskaya area, struck a gusher in 1956. In 1959, gushers were struck in well No 750 of the Voznesenskaya field and well No 100 of the Ali-Yurt field.

Later on, Upper Cretaceous petroleum was discovered at Khayan-Kort, El'darovo, Akhlovo, Starogroznenskaya, Sernovodskaya, Oktyabr'skaya, Gudermesskaya, and elsewhere. During the days of the 23rd CPSU Congress, a powerful gusher was struck in wells of the Bragunskoye field.

The discovery of petroleum in Mesozoic deposits created the conditions for stepping up the pace of petroleum production. But declining formation pressure in productive horizons of the Upper Cretaceous deposits complicated the already difficult geological-technical conditions of drilling. Gradients of formation pressures in deep-lying Upper Cretaceous deposits declined to 0.11--0.09 $(kgf/cm^2)/m$, while in the more shallow-lying Maykop deposits they stayed within the range of 0.19--0.22 $(kgf/cm^2)/m$. As a result of this, loads on intermediate strings increased considerably and reached critical levels. Sometimes they even broke down and crumpled.

In order to boost petroleum reserves further it became necessary to drill even deeper--into Lower Cretaceous and Jurassic deposits at depths of 5,000 to 6,500 meters. In such wells it was necessary to pass through six to seven intervals that were incompatible in terms of drillability.

The optimal variant for combining casing pipe sizes in this case proved to be 426X324/340X273X219X168X114.

Because of steeply-tilted strata (angles of incidence between 20 and 80 degrees), and the presence of interbedded AVPD [anomalously high formation pressure] and ANPD [anomalously low formation pressure] zones, bottom-hole temperatures running as high as 160 to 200°C at projected depths, and other complications, the drilling of such wells required solutions to a number of problems.

1. Regulation of the rate of well deviation at all intervals, especially when drilling shafts of 394, 190, and 140 mm diameter.

2. The development of a highly-productive rock-breaking tool providing increased penetration after ramming a multiple number of times.

3. Formulation of a technological process and technical means for drilling with regulated differential pressure in the well-stratum system both under AVPD and ANPD conditions.

4. The development of technical means and technological processes providing high-quality well reinforcement under conditions of low clearance (6 to 8 mm).

In addition to SevKavNIPIneft' [North Caucasus Scientific-Research and Planning Institute for Petroleum], VNIIBT [All-Union Scientific Research Institute for Drilling Techniques] was also enlisted to solve these problems; the latter set up a division in Groznyy.

In order to determine the most effective technical means for preventing well deviation, the association, in collaboration with VNIIBT and SevKavNIPIneft', drew up a program of projects to test wells; the program included components developed by the institute consisting of RTB's [reaction turbine drills], TVK-240 turbo drills with rotating body, pilot reamers of the RDU [expansion unknown] and ROP [expansion unknown] type in combination with high-momentum A9GT, A9GTSh, and TVK-240 turbo drills, eccentric adapters, and other items.

As a result of efforts begun in 1973, optimal spheres of application were determined for technical means and drilling methods which permitted the drilling of shafts 394 mm in diameter down to depths of 3,000 to 3,300 meters in complex geological conditions with stratal angles of incidence of up to 80 degrees.

The technical-economic indicators thus achieved make it possible to affirm that practical solutions have been found to the problem of preventing deviation of the well shaft under the first technical string of 324 mm diameter and also problems of preventing pipes from wearing out due to kinks, failure to lower the strings to projected depths, and so on. Technical drilling speeds have risen by 1.5 to 2 times in comparable conditions.

Between Feburary 1974 and October 1975, the drilling enterprises of Grozneft' were completely outfitted with high-momentum sectional turbo drills and reaction turbine drills of the latest design. The use of effective types of bits substantially speeded up and lowered the cost of deep well drilling. For this reason, the association has focused special attention on the testing of new bit designs.

In collaboration with VNIIBT, SevKavNIPIneft' has tested more than 15 type sizes of new bits of the AN series in the last three years. As a result, the penetration per bit, mechanical speed, and endurance have

increased from 22 to 25 percent. Especially good indicators have been achieved with ZAN [expansion unknown] bits, which have increased drilling rates by 4.5 to 5 times with the use of clay mud with densities of 1.96 to 2.0 grams per cubic cm.

Recent years have seen an increased amount of drilling using bits fitted with natural and synthetic diamonds. In 1976, diamond bits accounted for 4.1 percent of all drilling.

Analyzing the results of diamond bit operation, we may comment on their great potential capabilities. Thus, during the drilling of Braguny well No 73, a single MDR-140ST-1 bit was used to drill 410 meters of Upper Cretaceous deposits in the interval 4,776 to 5,186 meters; in Oktyabr'skaya well No 250--350 meters in the 4,576--5,068 meter range. Using just one or two bits, it is possible to open up Upper Cretaceous deposits to full capacity.

In 1973--1975, SevKavNIPIneft' developed a new design single-cone bit which is 30 to 40 percent more effective than the previous design. Three models of the bit--I190.5-SZ-N, I139.7S-Z-N, I215.9-SZ-N--have been accepted for series production and awarded the State Emblem of Quality.

Also newly designed is the OS-244.5 single-cone bit for drilling in mycop deposits at depths of 3,000 to 4,500 meters. Industrial tests have shown that the new bits produce three times the amount of drilling compared with the best models of three-cone bits.

One of the most promising directions in improving the technical-economic indicators of deep well drilling is the adoption of a technology designed to regulate differential pressure in the well shaft--stratum system. Joint efforts to solve this complex problem are being made in collaboration with Grozneft' by VNIIBT, SevKavNIPIneft', KOVNIInefteprom geofizika [Caucasus Department of All-Union Scientific-Research Institute of Petroleum Industry Geophysics], and Groznefteprom geofizika [Groznyy Petroleum Geophysics Trust].

In 1976, the technology of drilling with regulated differential pressure in AVPD zones was used in part to drill individual intervals in Zamankul well No 86 and Braguny well No 76. In well No 86, penetration per bit and mechanical speed increased by about two times, effecting a savings of 410 rubles per meter drilled. In well No 76, with the bottom hole at 4,400 meters, construction times were speeded up by 210 days.

The technology of drilling on balance is based on a knowledge of the exact values of formation and hydrodynamic pressures. For this reason, any rise in volumes of drilling with the use of such technology is being held back by the lack of appropriate measurement equipment as well as tested methods of predicting formation pressures on the basis of geophysical studies.

A complex of means has been developed and widely adopted for drilling without the loss of drilling mud through reliable sealing of the annular and pipe space in the conduct of all types of operations (drilling, SPO [expansion unknown], pipe connection, eletrometrical, and fishing operations, and so on). This has made it possible to reduce by almost two times the cost of drilling in Upper Cretaceos deposits with ANPD's formed as a result of long-term field exploitation.

With regard to well reinforcement, a complex of means has been adopted (a threaded disconnector mounted on a cement stone for removable casing strings, a device for cementing liners, a cement valve for sectional strings, and so on); they provide for lowering casing strings in sections, mounted on cement stone, in the case of small annular clearances.

Also developed and now being successfully used is a new technology for cementing strings under ANPD conditions. The quality of cement work is being improved through the use of modernized cement mixing equipment. For this, considerable credit goes to SevKavNIPIneft' scientists who have resolved these problems in close cooperation with production workers.

In a relatively short time, therefore, Grzonyy production workers and scientists resolved the problem of drilling in ANPD zones.

During the Ninth Five-Year Plan and the first year of the Tenth Five-Year Plan, Grozneft' drilling enterprises drilled 1,081,800 meters, built 240 wells, and discovered 11 petroleum fields. The average depth of completed exploratory wells rose from 4,417 to 5,071 meters. Moreover, the average penetration per bit increased from 24.7 to 33.1 meters.

At the start of 1977, the drilling crew headed by U. Z. Shidiyev and drilling foreman L. Ya. Buchnev reached the record depth of 7,501 meters in Burunnaya well No 1.

Substantial efforts are underway as regards the introduction of new equipment. In 1971--1976, Groznyy drilling enterprises adopted 12 new types of drilling equipment and tools (UPR-R2 and BPR-100 units for making and treating drilling mud, ultrasonic defectoscope and thickness-gauge units, storage facilities for MS-900 dry mud materials; RTB reaction turbine drills, semi-automatic machinery for welding casing pipes above the mouth of the wells, a KUB-1 remote control system, and so on); seven types of materials (a modified bentonite mud with a return of 10 to 15 cubic meters per ton, UShchR [expansion unknown] and KSSB-4 powder-form reagents, slag cements, IBR [expansion unknown] oxidized asphalt, and so on); two automation and remote control systems, three technological processes (jet bit drilling with discharge rates of 80 to 110 meters per second, the use of IBR, and well reinforcement by means of welded casing strings). The adoption of these yielded an economic effect of 14.5 million rubles. The use of new types of bits has yielded savings worth 3.1 million rubles, casing and drill pipes--3.6 million rubles, formation testers--1.2 million rubles, and new materials a and reagents for the making and treatment of drilling mud--2.8 million rubles.

Responding with shock work labor to the CC CPSU decree "The 60th Anniversary of the Great October Socialist Revolution," the Order of Lenin collective of Grozneft' in the Chechen-Ingush ASSR has initiated socialist competition for a worthy greeting to this glorious date and ahead-of-schedule fulfillment of the targets of the second year of the five-year plan. This initiative has been widely supported by collectives in all enterprises of industry, construction, and transport.

The following winners in 1976 all-union socialist competition--drilling crews headed by foremen G. Sh. Khantemirov (Malgobekskoye UBR), V. D. Shvetsov (Starogroznenskoye UBR), V. D. Tomazov (Goryachevodskoye UBR), and also I. M. Shulikin, A. A. Dokhkil'gov, A. Ya. Sal'nikov, B. A. Kayushnikov, A. B. Ibragimov, P. A. Tarakanov, and V. F. Mel'nikov--have adopted obligations to complete targets of the two years of the five-year plan by 7 November 1977, and they are successfully fulfilling them.

The use of new types of drilling equipment and bottom-hole engines in combination with effective rock-breaking tools and high-strength drilling and casing pipes, also improved quality in mud operations and new technological techniques and methods in drilling, will make it possible to achieve even greater improvements in equipment and technology for the drilling of superdeep wells in complex geological conditions. This constitutes one of the basic directions in the activities of all subunits of Grozneft', because most of the predicted petroleum and gas reserves which will serve as the basis in the current five-year plan and subsequent years for the development of the petroleum industry in this region lie at depths between 5,500 and 8,000 meters.

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DEVELOPMENTS IN DRILLING RIG CIRCULATION SYSTEMS

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 70-72

[Article by M. Sh. Vartapetov, R. V. Sidorov (VNIINEFTEMASh): "Basic Stages in the Development of Drilling Rig Circulation System Equipment"]

[Text] As late as the end of the 1950's, the drilling rig circulation system consisted mostly of earthen pits and wooden troughs.

In the early 1960's, we bagn to use rectangualr metal cylindrical enclosed tanks to store supplies of drilling mud and chemical reagents.

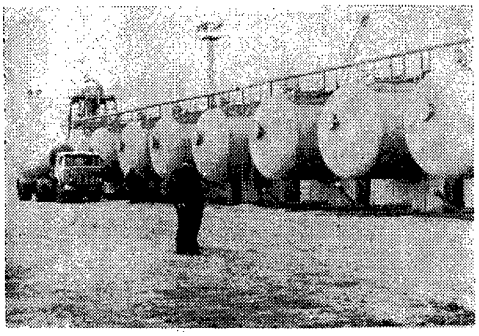
In the second half of the 1960's, work began on the development of an improved complex of circulation system equipment in blocks with base tanks of 40 cubic meters capacity containing a built-in chute, collector, conduits for the mud, water, steam, and equipment for cleaning and treating the mud. A block was developed for making mud out of powder-form materials of the BPR [mud preparation block] type. In 1970, series production began of a complex of blocks with a unitized base tank of 40 cubic meters capacity, developed by VNIINEFTEMASh [All-Union Scientific Research Institute for Petroleum Machine Building] in collaboration with drilling enterprises of Ministry of Petroleum Industry, for circulation systems of all classes of drilling rigs.

At present, for the composition of petroleum and gas operational and deep well exploratory drilling, circulation system complexes are being turned out which include the following blocks: scrubbing (10 designs), intermediate and angular (8 designs), reception (3 designs), those equipped with pressure pumps (2 designs), a block for making mud out of powder-form materials, and a block for storing chemical reagents. The blocks include the following component items: SV2B screen shakers, a 1PGk sand remover, a DVS2K degasser, PG hydraulic blenders and 2PM mechanical blenders, and a 5V-9 vertical slurry pump.

For rapid installation and dismantling of circulation system blocks, appropriate fast-disassembly components have been developed. Thanks to these components with chute seals, auxiliary pressure pipelines, collectors, and water and steam conduits of adjacent blocks in the circulation system are interconnected without the use of welding operations. These connections

are capable of compensating for inaccuracies in the mutual placement of connected chutes and conduits. Most of the circulation system blocks have been awarded the State Emblem of Quality.

In connection with the extensive use of powder-form materials, work has been completed on the development and startup of series production (in enterprises of the Ministry of Chemical and Petroleum Machine Building and the Ministry of Petroleum Industry] of 2BPR and 1BPR blocks for making and weighting the drilling mud, also MS900 storage equipment (Fig 1) with containers operating under pressure. The total container capacity is 900 cubic meters--that is, it provides for storing about 1,200 tons of dry mud or 2,400 tons of barite weighting material.



MS-900 Mechanized Storage for Dry Mud Materials

The "Safety Regulations in the Petroleum Producing Industry," approved in 1974, stipulate the following norms of mud supplies (in cubic meters) for drilling rigs:

Drilling depth, meters	Type of rig	Usable volume of circulation system, cubic meters
2,000	BU-50	90
2,500	BU-80	90
3,000	BU-100	120
4,000	BU-125	150
5,000	BU-160	180
6,500	BU-200	240
8,000	BU-250	300
10,000	BU-10,000	360

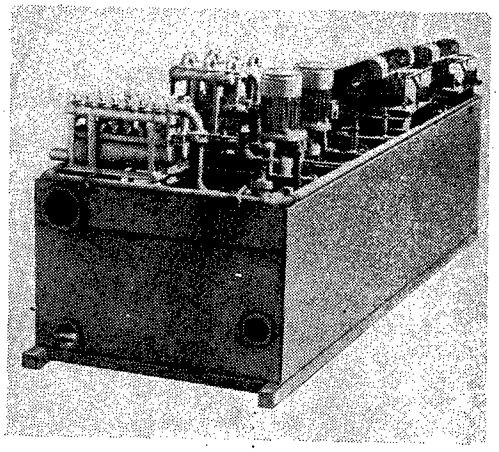
From BU-50 to BU-80	120
From BU-125 to BU-160	240
From Bu-200 to BU-250	360

The development of BPR type blocks, improvements in the quality of dry mud, weighting materials, and chemical reagents, and also improved reliability of blowout prevention equipment and increased strength of casing strings, have made it possible to revise norms of usable volumes of drilling mud in drilling rig circulation system blocks of all classes. In 1976, USSR Gosgortekhnadzor [State Committee of the Council of Ministers for Supervision of Industrial Safety and Mining Inspection] approved new norms (see table).

The introduction of new norms governing the circulation system volume on the basis of research by specialists in the Ministry of Petroleum Industry and its organizations will help to achieve substantial economic effects. They will make it possible to put together compact drilling rig circulation systems of all classes with base tanks of two type sizes: 40 cubic meters (useful volume 30 cubic meters) for depths up to 4,000 meters deep inclusive, and 70--80 cubic meters (useful volume 50 to 60 cubic meters) for wells 5,000 meters deep or more.

Being one of the basic parameters of drilling rigs, norms of circulation system volumes are stipulated in sector standard OST 26---02--807--73 "Drilling Rigs for Operational and Deep Exploratory Drilling. Basic Parameters" (amendment No 2).

In 1977, industrial tests were begun on experimental models of circulation systems with unitized base tank of 60 cubic meters useful capacity. Figure 2 shows the general appearance of a UBO-1 scrubbing block with a base tank of 80 cubic meters capacity.



UBO-1 Type Scrubbing Block

Further increases in drilling speeds and the development of powerful three-cylinder one-side action drilling pumps, jet bits, and high-momentum hydraulic engines, have put forth as one of the most high-priority tasks that of

sharply improving the effectiveness and reliability of equipment for scrubbing mud. In 1978-1979, plans call for the industrial manufacture of the following equipment: a V-21 one-piece two-stage shaker screen and a V-12 (SV2V) one-stage double shaker screen, which make it possible to remove particles up to 0.16 mm in size from the mud; PG-50 and PG-90 hydraulic cyclone sand removers (Fig 3) with productivities of 40 to 50 and 80 to 90 liters per second, respectively, which make it possible to remove practically all particles of 0.08 mm or more, also a substantial amount of particles between 0.06 and 0.08 mm; IG-45 hydraulic cyclone sludge removers (Fig 4) of up to 45 liters per second productivity, which will make it possible to remove all particles of 0.05 mm from the drilling mud, also substantial amounts of particles between 0.03 and 0.05 mm; centrifuge mud separators which make it possible to reuse the weighting materail separated from the excess drilling mud; and DVS-2 vacuum degassers with a productivity of 40 to 45 liters per second and also 60 to 65 liters per second.

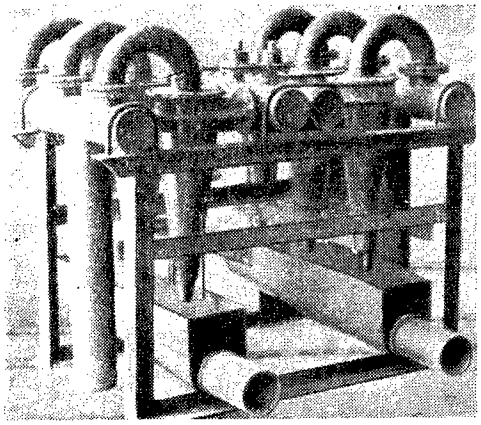


Fig 3. PG-90 Hydraulic Cyclone Sand Remover

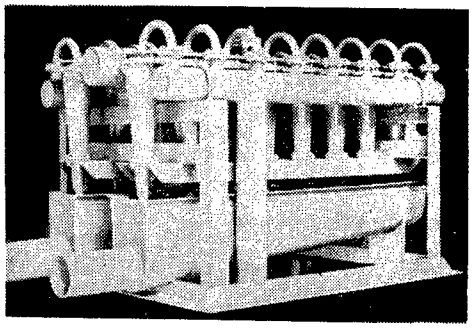


Fig 4. IG-45 Hydraulic Cyclone Sludge Remover

The adoption of the shaker screens and the mud separator will substantially boost the extent of scrubbing of weighted drilling mud. According to VNIIKRneft' [expansion unknown], the use of the present shaker screen removes only 8 to 10 percent of the drilled rock from the mud. The new shaker screens will make it possible to remove 40 to 50 percent.

In addition to experimental-design work, VNIINEFTEMASh is collaborating with VNIIKRneft' and MINKhiGP [Moscow Institute of Petrochemical and Gas Industry imeni Academician I. M. Gubkin] on theoretical and experimental research oriented toward design improvement and the establishment of optimal values for the most important technological parameters of equipment for mud scrubbing.

During the Tenth Five-Year Plan, a solution will be found to the task of developing and starting the industrial production of unitized blocks for storing powder-form materials and making drilling mud with the desired parameters. These include the BPR-70 block for making drilling mud out of powder form materials, equipped with hoppers totaling 70 cubic meters capacity, a powder weight indicator, an ejector-hydraulic mixer, and disperser; the SB-140 base storage equipped with hoppers of 140 cubic meters capacity; and a rail side SP-200 storage equipped with hoppers of 200 cubic meters capacity. The hoppers of all of the blocks will be of standard diameter, support and bottom design, and other components, and made in the form of modules which can be put together in any number to quickly assemble a storage facility of the required capacity.

The development and adoption of these standardized blocks will improve the quality of drilling mud, build up necessary stocks of powder form materials in drilling zones at locations where railroad cars are unloaded, at drilling enterprise bases, and at drilling sites, and will also reduce losses of materials during loading-unloading operations and storage.

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NEW DESIGN OF PLUGGING MUD MIXING MACHINERY

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 72-74

[Article by N. I. Makushev and O. I. Bezdrobnyy (VNIIKRneft'): "Improving the Technology of Making Plugging Mud"]

[Text] In well cementing operations, because of severe foaming sometimes not all of the plugging mud is removed without overflow even in the presence of two cementing units (chiefly in the case of mixing cement-bentonite mixes using SSB [sulfite-liquor waste] in the amount of 0.9 percent or more). Foam in the mud reduces the filling coefficient of the 11T pump of 2TsA-400A cementing unit.

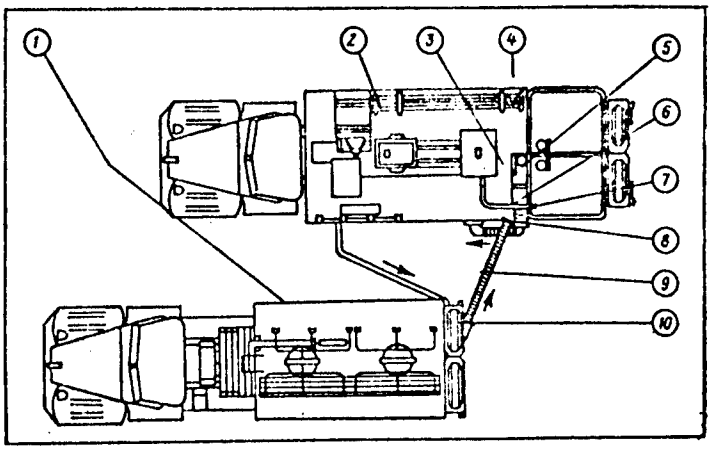
In order to eliminate the action of the foam and improve the filling coefficient of the cementing pump, a new flow pattern has been proposed for the making and injection of the plugging mud [1]; in it, the cement tank is placed above the mechanical part of the 11T pump, appropriate connections are made, and normal pump operation is assured. This has made it possible to remove all of the plugging mud prepared in a 2SMN-20 cement mixing machine in all operating modes and with a SSB content of more than 0.9 percent.

At the same time, field tests have shown that work done in accordance with the new pattern requires the placement of an additional cement unit just to feed the mixing liquid into the hydraulic-vacuum mixer.

Subsequent research resulted in the development of an improved technology* for making plugging mud; the new technology makes it possible to reduce the number of cement units at each mixing point, to make better use of the installed capacity of drive engines, and to improve the operators' working conditions (Fig 1).

*This work was participated in by A. S. Zatalokin, Yu. M. Yeremenko, I. N. Bortko, and workers in the plugging mud office of OKNG [expansion unknown].

Fig. 1.



Pattern of Placement and Connection of Cementing Equipment in the Process of Making Plugging Mud

In well cementing operations with the new technology, the cementing equipment at each mixing point includes a 2SMN-20 cement mixing machine (1) and a TsA-320M cementing unit (2), which is outfitted with the following additional devices.

Mounted on the bed of the TsA-320M unit alongside the measured container is a special cement tank (3) equipped with a bottom valve (4), a grate (5) which divides the cement tank into two parts, a receiving branch pipe (6) with a fast-release connecting nut, a float-type level gauge (7), and a sample taker installed in the lower part of the tank. Welded into the bottom of the tank is a branch pipe which is connected to the receiving collector of the cement pump by means of a flexible pipe (8) and two sets of fast-release connections. A hydraulic-vacuum mixer (10) is connected to the cement tank by means of a flexible hose (9) about 3,000 mm in length and D_y=75 mm. One end of the flexible hose is equipped with a sleeve which goes into the opening of the body of the mixture and is attached with a snap latch; the other end is attached with the matching part of the fast-release connection.

With regard for rational placement and convenience of service, the cement tank is vertical and has the dimensions 300X1000X800 mm.

The cementing and cement-mixing equipment is started up in the same sequence as in the case of the existing technology of making plugging mud. There are differences, however, in servicing the equipment.

In order to feed the plugging mud into the cement tank installed on the unit bed, it is necessary to open the gate valve in front of the mixing device to

allow the dry binder to enter when the injection pressure of the mixing liquid is at 1.4 MPa or higher. Substandard plugging mud that is produced at the beginning of the mixing process is dumped out of the cement tank by the cement unit operator by operating the handle of the discharge valve. The required level of drilling mud in the cement tank is maintained by the driver of the cement unit by changing the number of revolutions of the cement pump drive, guided by the reading on the level gauge. Samples of ready plugging mud are removed by a technician from the cement tank by turning the handle of the sample remover.

The cementing of more than 50 wells in Krasnodarneftegaz [Krasnodar Petroleum and Gas Association] has demonstrated the possibility of insuring fixed plugging mud injection regimes and the compatibility of the output rates of the cement mixing and cementing equipment. It has been found, at the same time, that the use of series-manufactured hydraulic-vacuum mixers makes it difficult to make plugging mud out of portland cement with a density of more than 1.76 grams per cubic cm. Attempts to increase the density of the plugging mud by increasing the feed of dry binder into the mixer caused the material to cake in the receiving chamber of the hopper.

The main reasons for this are the following.

1. Defective design of the receiving chamber of the series-manufactured hydraulic-vacuum mixer (the presence of slanted walls causes the material to move vortically in the receiving chamber and, consequently, a reduction in the feeding of the dry binder into the mixer [2]).

2. An increase in the amount of liquid phase in the mud because of the necessity of increasing the injection pressure of the mixing liquid through the particular diameter of the connecting pipe, and the limited feed of dry binder for blending.

3. The substantial influence exerted by the dimensions of the jet projection on the carrying of the dry binder. Thus, reducing the diameter of the connecting pipe in order to reduce the amount of the liquid phase in the mud entails a reduction in the size of the projection of the jet and the amount of dry binder carried away by the jet for blending. When the diameter of the connecting pipe and, consequently, the size of the jet projection, is increased, the amount of dry binder carried away by the jet for blending increases. At the same time, however, the discharge rate of the mixing liquid through the connecting pipe also increases; this makes it impossible to substantially increase the solid phase content in the mud.

In order to eliminate the effect of these factors, a double-pipe hydraulic-vacuum mixer has been designed* (Fig 2), consisting of a cylindrical steel

*The designing of some components was participated in by I. N. Bartko and A. S. Zatalokin.

body (6) with an elliptical converging tube (7) leading into a cylindrical mixing chamber (8), a valve (3) with hydraulic drive (2), which includes a cylinder, a plunger, a spring, a bypass pipe, and a lever. Attached to the side portion of the body of the mixer is the receiving chamber (4) equipped with two removable slotted connecting pipes (5) whose center lines come together in the mixing chamber (8), and a threaded branch pipe (1) for connection with the pressure conduit. The mixer set includes four sets of two identical connection pipes. Every pair of connection pipes has a combined slot area corresponding to that of the passage openings of one of the series-manufactured connection pipes, with diameters of 10, 12, 14, and 16 mm.

In the making of plugging mud, the projections of the two jets of mixing liquid coming out of the slotted nozzles take up a larger portion of the space inside of the mixer body than in the case of a single-jet mixer; this helps to carry away all of the dry binder for blending. In addition, as the two jets collide in the mixing chamber, the components of the mud are blended more thoroughly.

In the event that the plugging mud mixing process has to be stopped and, consequently, the feeding of the mixing fluid has to be stopped, the valve (3) is opened automatically by the action of the compressed spring of the hydraulic drive (2) (see Fig 2), and the mud flowing out of the flexible hose (9) (see Fig 1) is ejected out of the mixer body. The presence of a valve and hydraulic drive makes it possible to prevent the dry binder from getting wet in the receiving chamber of the hopper and to renew the mixing process without having to dismantle the hydraulic-vacuum mixer in order to remove wet plugging material.

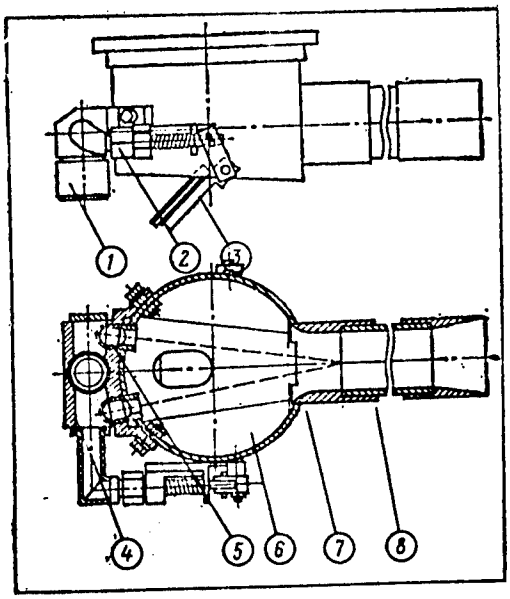


Fig 2. Double-Pipe Hydraulic-Vacuum Mixer

The use of the new technology for mixing plugging mud reduces by two times the number of cement units taking part in well cementing operations; it makes it possible to make fuller use of the installed capacity of their drive mechanisms, to exercise better control over technological parameters and the overall process, and to improve the working conditions of the operators servicing the cement-mixers and the cementing units.

BIBLIOGRAPHY

1. Bezdrobnyy, O. I., Makushev, N. I., "Novaya tekhnologiya prigotovleniya i zakachki tamponazhnogo rastvora" [A New Technology for Making and Injecting Plugging Mud], Moscow, VNIIOENG. RNTS, Seriya, "Bureniya," No 8, 1973, pp 22-24.

2. Mamvriyskiy, A. S., "Prichiny nestabil'nosti udel'nogo vesa tamponazhnogo rastvora pri yego zatvorenii " [Causes of Instability in the Proportion of Plugging Mud When Mixed], Moscow VNIIENG. NTS, Seriya, "Bureniye," No 4, 1970, p 26.

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NEW TECHNICAL, TECHNOLOGICAL DEVELOPMENTS IN PETROLEUM

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 77 pp 75-79

[Brief item on technical and technological development: "Information. Science to Production"]

[Text] Procedure for Regulating Deposit Exploitation

The procedure is based on the theory of well intervention, from which it follows that in the process of deposit exploitation under conditions of water expulsion of the petroleum some wells--depending on the distribution of pressure in the stratum and the extent of water flooding--may be effective or ineffective. We consider those wells to be effective whose operation insures a positive increase in petroleum output per site, while we classify as ineffective those wells whose output declines and whose yield of byproduct water increases unjustifiably.

The chosen criterion of effectiveness is the effectiveness coefficient representing the ratio of the increase in petroleum output per object as a result of operation of a given well to the petroleum output of the well itself. The effectiveness coefficient quantitatively characterizes the effect of a given well's interference with all the other wells of a given site, and can be determined by the method presented in the manual for determining the technological and economic effectiveness of measures designed to boost well productivity.

Depending on the changing distribution of water flooding in the petroleum from producing wells of a site, effectiveness coefficients for particular wells will change, alternating between positive and negative values. The shutting down of wells with negative coefficients, except for wells which have to be operated continuously because of geological conditions (dead-end zones, lenses, and so on) and, conversely, the starting up of wells in which the effectiveness coefficient again takes on positive value, tend to slow down the rate of petroleum yield decline (or even to increase the yield) and reduces the recovery of byproduct water.

When ineffective wells are shut down, the output of the other wells rises if the bottom-hole pressure in them does not vary and the pressure on the injection lines does not drop. But in pump operation, in order to insure constant bottom-hole pressures, it is necessary to vary the operating conditions of the pumping units or to use more productive units.

Thus, the proposed method of regulating the exploitation process boils down to the following basic operations: shutting down ineffective wells; putting effective wells into operation (from among the number of shut-down wells); regulating the operating regimes or varying the productivity of the equipment in order to maintain bottom-hole pressure at the desired level.

The All-Union Scientific Research Institute has developed a procedure for calculating well effectiveness coefficients. It uses data on well outputs and water flooding, also readings of bottom-hole and formation pressures in all wells of a site; these can be obtained easily at any field. The coefficients are calculated either by hand or by computer.

The practical value of the findings is not limited to using them to regulate exploitation processes. Knowledge of effectiveness coefficients also makes it possible to correctly calculate the technological (and economic) effect of any measures designed to increase well productivity; this substantially increases the effectiveness of these measures as a result of selecting the proper sequence in which they are to be carried out and excluding ineffective wells from work plans. The same thing applies to current repair operations.

Industrial testing of the described regulating procedure has been carried out at the Bondyuzhskoye and Pervomayskoye fields of Prikamneft' NGDU [Petroleum and Gas Production Administration], by Tatneft', and by the All-Union Scientific Research Institute.

At the Bondyuzhskoye field, ineffective wells began to be shut down in October 1974; later on, at the beginning of each quarter, wells were stopped or started in accordance with calculations. On the average over the year (from November 1974 through Novemebr 1975), in connection with the regulation, 30 of 159 wells in the operating inventory were idle. As a result, the recovery of byproduct water declined by 518,000 cubic meters per year compared with what was anticipated, and additional petroleum production amounted to 184,000 tons. The number of current repairs at the field, compared with the preceding year, declined by 21 percent. The annual economic effect gained from the method amounted to 760,000 rubles.

At the Pervomayskoye field, regulation experiments began in May 1975. As a result, the production of byproduct water dropped by 27 percent while the petroleum yield rose by 7 percent over the anticipated level.

The use of the method does not reduce the final yield of the strata, because in the long run all of the wells are exploited to the economically-feasible limit of water flooding. Moreover, the use of the method increases the final yield as a result of the expansion of the water expulsion process in the strata due to favorable changes in the directions of stratal filtration flows.

VNIITB [All-Union Scientific Research Institute of Safety Engineering in the Petroleum Industry] has developed a device to facilitate cleaning of the outside surface of pumps in shop facilities prior to disassembly and transport; it can be operated between 10 and 50 degrees C.

The device consists of a brush drive unit, a roller drive, and a support roller unit mounted in a single frame, and is fastened to the footing by an anchor bolts.

The roller drive unit consists of two electric engines connected to the rollers by a sleeveand a worm reducer. The brush drive unit, installed on a slab, consists of an electric engine and V-belt drive, connected to the brush shaft. The brush feed in radial direction is regulated by the drive, depending on the standard size of the pump to be cleaned. The support roller unit uncludes two pipes to which eight connectors are welded. Eight rollers are attached between the connectors.

All three electric engines are controlled by one switch.

Technical specifications

Capacity of electric engine, watts	1,100
Rate of feed, meters/minute	4.5 - 5.7
Number of brush revolutions, rad/second	97.33
Productivity, pump/hr	10
Dimensions: mm	
length	1,000
width	1,020
height	1,565
Mass, kg	500

The device works as follows. The pump to be cleaned, or its housing, is placed on the receiving rollers and tightened by lowering or raising the crosspieces. The rollers are set at an angle of α to the axis of displacement of the pump being cleaned, and impart to it a forward rotating movement. The rotating metal brush coming intocontact with the outside surface of the pump removes dirt or paraffin from it. Changing α increases or reduces the displacement speed of the pump.

The forward-rotating movement of the object being cleaned is reversible; this makes it possible to repeat the process if the cleaning is unsatisfactory. Forward and reverse are powered.

TatNIPIneft' [Tatar Scientific-Research and Planning Institute for Petroleum] has developed and tested, in collaboration with Tatneft', a technology for completing wells that permits maximum retention of the collector properties of the productive strata. First, the stratum is drilled in by boring and then (a second time) by perforation using a GER [water-repellent emulsion mud]. The strata are partitioned by means of a water-repellent plugging mixture based on OF-1 resin.

The parameters of the GER make it possible to use it in both turbine and rotary drilling, and in strata drilling-in they staisfy the requirement of retaining their impermeability.

The dispersion medium used to make the GER is a bituminous distillate from the Shugurovo asphalt plant. It is seven times cheaper than the diesel fuel used to make VIER [highly-concentrated invert-emulsion mud] proposed by VNIIBT. The dispersion phase for the GER is the stratal water of Devonian deposits or saturated water solutions of calcium chloride or calcium nitrate and other salts.

The emulsifier used is Smad-1 (a 50-percent solution of oxidixed petrolatum in diesel fuel) and emultal (a complex ester of triethanolamine and tallol).

Componential Composition of GER, percent by mass

Bituminous distillate	30-40
Stratal of industrial saline water	66-54
Smad-1	3-4
Emultal	1-2

Standard Indicators of Mud

Density, g/cm^3	1.0-1.7
Standard viscosity as per VP-2, sec	60-200
Statis chear stress, mgf/cm^2:	
in 1 minute	2-3
in 10 minutes	2-6
Electrostability, volts	200-250

GER can be made centrally (at clay plants) or directly at the drilling site; but a definite procedure must be obeyed in introducing the ingredients: first, the bitumninous distillate, Smad-1, and emultal are blended; then the saline water is dispersed in the indicated mixture.

The GER is weighted with barite (perferably a dry grind). The water content during preparation of an unweighted mud must be reduced by the amount of the volume occupied by the corresponding amount of the weighting material. For making the water-repellent emulsion plugging material, a mix is made of bituminous distillate, OF-1 phenol-formaldehyde resin, and benzenesulfonic acid (density 1.10 g/cm^3) in the following amounts, respectively: 8--11, 81--74, and 11-15 percent by mass.

Two days after mixing, the plugging material has a strength that is two to four times higher than cement, also increased resistence to the aggression of stratal water.

Another characteristic of the plugging material is the fact that it does not harden when the petroleum phase in its composition is increased. For this reason, when it gets into the productive horizon and mixes with the petroleum, it also does not harden in the pores of the bed; this helps to maximally retain the natural permeability of the productive strata when they are partitioned.

The new technology is highly effective. Thus, the application of it to Kuakbashskaya well No 15453 (Tatneft') increased well productivity by 2.85 times compared with the productivity of wells using emulsion clay muds. Studies have shown that in well No 15453 the operating capacity of the stratum equalled 100 percent of perforated.

The economic effectiveness of the new technology amounted to 22,400 rubles per well.

The Druzhba Long-Distance Pipeline Administration has developed a stationary foam extinguisher which makes it possible to localize and extinguish fires which break out in petroleum contained in reinforced concrete tanks of 30,000 m^3 capacity.

The flow pattern of the unit includes a 200D-60 fire pump, a TsV-6.3/160 metering pump, 29 GPV-600 high-multiple foam generators, a metal water tank of 1,000 m^3 capacity, a foaming solution container of 10m^3 capacity, piping of various diameters with clamp fittings which make it possible to shut the unit down for repairs, and control and automation instruments. The flow pattern can be adopted both in reinforced-concrete tanks under construction and in operational ones by using materials available in all pipeline transport enterprises.

The stationary foam extinguisher operated automatically. When fire breaks out in the stored petroleum, signals coming in from TRV-2 sensors trigger the automation system to open electric valves and turn on the pumps. The foaming solution is fed through the piping to the 29 GVP-600 generators placed on the collector around the tank perimeter at a distance of 2.5 meters from the well.

Fires are extinguished by the foam produced as a result of mixing three components in definite proportions in the generator: water, foaming solution, and air. The foam, with a multiple of at least 70 (ratio of the amount of foam produced to the amount of initial solution), is formed of a four-percent water foaming solution PO-1 (GOST 6948--70) by feeding it onto the grate of the foam generator in the form of an atomized spray. The discharge rate of the water foaming solution is 640 m^3/hr.

The Trans-Siberian Long-Distance Pipeline Administration has developed a relay designed to protect 6-kilovolt electric motors on mainline and support units of petroleum pumping stations against single-phase ground faults. The relay can also be used in compensated open networks of 6 to 10 kilovolts to protect other high-voltage consumers with a self-capacitance in each which does not exceed 20 percent of the total capacitance of the network.

The relay consists of a housing and a printed circuit on which all the elements of the circuit are mounted, which includes a matching transformer, a booster, a control relay, and a rectifier bridge.

When a single-phase short circuit develops, the zero sequence current transformer sends a signal through the matching transformer to the input of the booster. The circuit is fed only at the moment of short circuit from the "open triangle" winding of the zero sequence voltage transformer. When the short circuit current reaches the unit's current level, the control relay is tripped and gives the command to disconnect the oil circuit breaker.

Technical Specifications

Set point currentm A	0.4--10
Dimensions, mm	113X110X90
Mass, kg	0.5

The relay is used in conjunction with TZL and TZLM type current transformers and NTMI type voltage transformers.

The provisional annual economic effect from the adoption of a protection set consisting of siz relays comes to 250 rubles per petroleum pumping station. A set consisting of six relays has been installed at the Nizhne-Udinskaya petroleum pumping station.

TatNIPIneft' has developed small-sized, all-purpose, high-strength fittings (APU2M-65/50-140) designed for equipping well mouths operated by the gusher method using electric deep-well and deep-well sucker-rod pumps.

The fittings make it possible to convert from one operating method to others without having to change the well mouth connections. No welding work is needed when rearranging the fittings. The fittings make it possible to conduct well investigations relating to the start-up of deep-well instruments both through the central channel (gusher layout and electric centrifugal pump layout) and through the annular space (layout for ShGN [expansion unknown]).

Technical Specifications

Working pressure, kgf/cm^2	140	
Standard channel passage, mm:		
central	65	
side	50	
Environmental air temperature, °C	from -40 to +50	
Diameter of thread for mounting NKT, mm	73	
	Electric centrifugal pump gusher method	ShGN
Dimensions, mm:		
height	660	510
length	860	860
width	680	680
Mass, kg	232	196

The mass of the complete set of fittings is 257 kg. The fittings consist of a housing, a KFPL-65-140 buffer straight cock, angle valves installed on the side taps of the housing, a T-joint, and a branch pipe connecting the outlets of the annular speace and the central channel. The bodies of the angle valves and the black flange have connecting pipes for installing valves with manometers.

The average annual economic effect from the adoption of the well mouth fittings comes to 283 rubles per well.

VNIISPTneft' [expansion unknown] has developed a NPS [petroleum pumping station] based on two PGNU-2ZhR pumping units with gas turbine drive (one is a stand-by unit). The PGNU-2ZhR consists of two blocks--a turbine pump block and a control block--each of which is installed in its own frame and can be transported by truck, rail, or air.

Technical Specifications

Main pump	10ND-10X2
Productivity, m^3/hr	800
Pump pressure, m	265
Rotor rotation speed, RPM	2,975
Drive	AI aircraft type gas turbine engine
Rated capacity, hp	
Fuel	T-1, TS-1, or TS-2 kerosene; or diesel
Fuel consumption, kg/hr	1,450
Mass, kg:	
turbine pump block	9,000
control block	9,100

The unit is mounted on an open platform. The block design of the unit reduces the labor-intensiveness, cost, and construction time of the NPS. The presence of a 12-kW diesel-electric unit to drive the auxiliary electrical units provides autonomous electricity.

Capital outlays on the construction of the NPS come to 210,000 rubles.

The annual economic effect from the adoption of such an NPS on the Ishimbay--Orsk pipeline is 1.091 million rubles; the pass-through capacity of the pipeline is increased by 1.5 million tons per year.

The Central Siberian Long-Distance Petroleum Pipeline Administration has developed and introduced the IROL-3 performance indicator for facilities on the line portion of pipelines. The indicator provides remote-control over the condition of SKZ [cathode protection stations] of long-distance pipelines located in inaccessible areas. Information indicating the norma functioning of the station is given in the form of light impulses from the SKZ being monitored. A missing light impulse indicates a malfunction in the SKZ or that the station's set parameters (the current of the superposed potential at the point of drainage) have gone beyond the allowable limits.

The IROL-3 is serviced by SKZ personnel at the site.

Technical Specifications

Number of input channels	2
Resistance of potential input, kilohms	300
Frequency range of request signal, Hz	60--300
Light impulse recurrence frequency, Hz	1
Environmental air temperature with relative humidity to 95 percent, °C	± 60

The economic effect from adopting the indicator is 20,000 rubles on 400 km of pipeline.

SevKavNIPIneft' [North Caucasus Scientific-Research and Planning Institute for Petroleum] has developed the OS244.5MS single-cone bit. Its main distinction compared to series-manufactured single-cone bits is the design of the armament. The cone is equipped with hard-alloy conical teeth of large size which extend 20 mm over the body.

The hard-alloy conical teeth are arranged on the cone in accordance with a set pattern to provide efficient grinding of the whole area of the face and reliable calibration of the well shaft.

They are attached by means of sleeves with conical openings. The sleeve is inserted together with the tooth into the depth of the cone and welded.

Flushing is accomplished through the opening in the body, from which the set of drilling mud is fed along the tangent of the cone surface, which has eight longitudinal grooves.

The base of the bit is a combination one, consisting of two roller bearings (one of which is lock-type) and wide sliding bases.

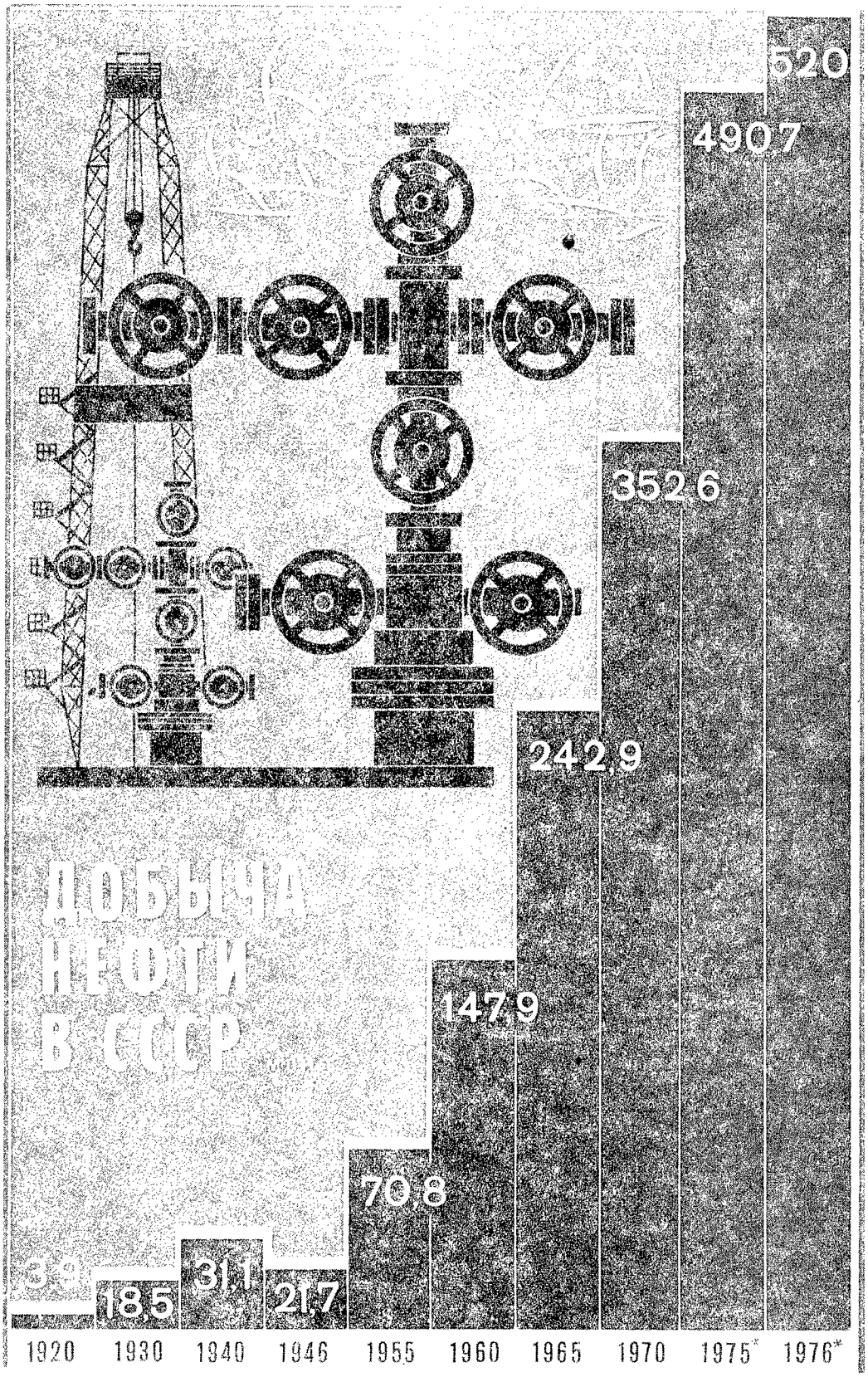
Uniform and efficient destruction of the rock on all segments of the spherical face, including the central portion, is provided (at small axle loads) by the relatively small contact surface of the armament and the bit's operating kinematics.

For protecting the bits' hard-alloy armament and the casing strings against mutual damage, the cones are fitted with special protective devices (shells made of epoxy resins, rubber protectors, texrope belt protectors, and so on).

Technical Specifications

Nominal diameter of bit, mm	244.5
Height of bit, mm	390
Type of body	Solid forged
Connecting thread	3-117 (GOST 5286--58)
Permissible axle load on bit, tf	6
Mass of bit, kg	45

The OS244.5MS bits have been industrially tested on 10 wells in Grozneft' in the drilling of deep wells (over 3,000 meters) in Maykop, Foraminifera, and Upper Cretaceous deposits, consistsing of dense clay, sandstone, marl, and limestone.



USSR Petroleum Production, millions of tons

Bit testing specifications: axle load 3-5 tf; rotor rotation speed 90-110 RPM; pump productivity 27--35 liters/second; density of weighted clay mud, 1.96 to 2.20 g/cm^3.

Penetration per bit 58.6 meters, endurance 33.5 hr, and mechanical drilling speed 1.75 m/hr made it possible to considerably improve technical-economical indicators of deep well drilling in Grozneft'. In addition, the curvature of the well shaft did not vary when the OS244.5MS bit was used.

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